# SCIENCE.

FRIDAY, MAY 23, 1884.

## *COMMENT AND CRITICISM.*

THE popular excitement as to food adulterations, and the difficulties met in dealing with this evil, lead to some queer results. The city of New York, with its vast population demanding supplies of cheap food, takes an extraordinary position as regards the two common articles of butter and milk. Instead of courageously undertaking the proper restriction and regulation of substitutes, and the prevention of fraud, the city authorities, through the board of health, now supported by the state legislature, propose to expel from the city markets all imitations of butter, and all skimmed milk. Oleomargarine and butterine have never competed with fine grades of butter. But, made in a healthy and clean manner, the substitutes have formed a legitimate, cheap, and palatable substitute for low grades of pure butter. Sold for what they are, a certain class prefer the imitations to poor butter, although genuine; but prohibition is to prevent this, and force up the prices of low-grade butter. Worse yet, is the exclusion of skim-milk from the city. One of the most wholesome and really valuable food-products, which, sold as skim-milk at a low price, would find a market almost unlimited, and prove a great blessing to the poor, is prohibited, and emptied in the gutter whenever found. The science of government must sadly need development, so long as it is thought necessary to thus cut off supplies of cheap and wholesome food from the poor of our great cities.

EVERY one remembers as one of the familiar, or perhaps better unfamiliar, sights of his school-days, a cabinet, — a closet with glass doors, containing a piece of quartz, a shell, a leg of a chair, and dust. Some one stirred by a love of nature, awakened for a moment by an essay at his teachers' convention, had been misled into placing the glass-doored case in one corner of the schoolroom, and the quartz and shell behind the glass. So it had stood for a week or month admired, then for six months neglected, and finally for years despised, during which last period the chair-leg had been added to the contents.

It would seem that this ghost of a cabinet haunts the English schools as much as ours. Ghosts love half-neglected, half-forgotten corners, and are quickly banished by plenty of new paint, and a proper use of the broom. To put an end to the haunting school-cabinet, a remedy is suggested by Rev. Henry H. Higgins, who proposes that a loan-museum shall be formed for the supply of schools with a few specimens at a time in the departments which the scholars may be studying. As a loan-museum will have, like a circulating-library, a limit to the time a specimen may be retained, there will be no chance for the stagnation which now takes place. It is also hoped that the museum would be able to supply a much better class of specimens than the schools could afford.

Mr. Higgins differs from many advocates of object-lessons in thinking that it is better to place before scholars first, not the common things of their neighborhood which may have beauty, but a beauty overlooked because too near, but "would take the large and beautiful exotic shell, Pinna, with its byssus of glossy silk, and the fashionable-colored gloves made of this material, and, after operating with these, would require the class to bring a large cluster of common sea-mussels, and would make the children find the silk-byssus." His idea appears to be, that the advantage of a child's being interested in a novel sight is not to be thrown away by disappointing him with a toad, and then showing him that he does not know all about toads.

AT the April meeting of the Royal astronomical society, Mr. Tupman announced that Dr. Arthur Auwers of Berlin had communicated to the society a paper on the chain of meridian distances, measured around the earth, between 1831 and 1836, in H. M. S. Beagle. Capt. Fitzroy was in command of the Beagle at that time, when she set out from Bahia, and went round the world, returning to that point. In working out the results, his selection of the chronometers upon which he based his determinations was somewhat arbitrary; and he found that the successive differences of longitude round the world, when added together, differed from twenty-four hours by thirty-four seconds. Capt. Fitzroy did not attempt to improve upon this; and the work has been left in that state until now, when Dr. Auwers has taken it up, and discussed anew all the chronometer-work on board the Beagle, using as the primary meridians those which have been correctly determined since, and correcting in this manner all the longitudes which resulted from the discussion of Capt. Fitzroy. Dr. Auwers's paper will be published in the *Monthly notices* of the society; and, as Fitzroy's longitudes have been to a great extent relied upon by the Hydrographic office in the construction of maritime charts, many of which are in use at the present day, the work of Dr. Auwers will be of great value in giving more accurate determinations of the longitude of distant islands than were before available.

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WHEN one passes through some sleepy New-England village, and has pointed out to him a building as the academy at which his grandfather or great-uncle once learned his Latin grammar, he wonders how his uncle, now selling stocks on Wall Street, or pleading before the full bench in Washington, or hoeing corn in Kansas, and this quiet building, should have come together, and why they parted, — an academy, a square building, with hip-roof, a belfry in the centre, and coated with paint of that sobered tone derived of a mortgage. There are no little uncles running about the building now; the chief life, or it might be said the soul, of the structure, existing in the records of the school (the newest quite yellow), the deed of the land, and an expired insurance-policy on the building, — a crumpled bundle of papers in the desk of the village doctor and only resident graduate, an enthusiast on the school, puffed with pride at his own success as a wiseacre.

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Such is the dead or dying academy, of which each town can produce its sample. A few, a half-dozen, still flourish, thanks to a rather more liberal endowment, or the fortunate circumstance of a long run of successful masters. Just at present there are some stirring the old bones to find those that may show sufficient signs of life to warrant an attempt at resuscitation, — a revival of interest possibly due as much as any thing to the restlessness of human nature, not contented with the high-school system developed as far as may be for the present.

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## LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

### The faults of south-western Virginia.

WHILE engaged in making a series of cross-sections in the above region in 1880, I had very frequent opportunity to study the structure of the faults; and, as a result, I reached certain conclusions, which may be of interest.

A conspicuous feature, which is of general, if not universal, occurrence along the line of faults, wherever exposed, is an angular fold, as in fig. 1.

An excellent section, showing its manner of occurrence, is found at the mouth of Russel Creek, a tributary of Clinch River. It is given in fig. 2, where, at *a*, coal-measures occur nearly horizontal and undisturbed; at *b* the millstone grit is standing vertically, forming an obstruction to the creek, and giving rise to perhaps the loftiest and most picturesque fall in the region; *xy* is the fault-plane (seen in the vicinity), to the left of which the Knox limestone (*c*) shows a dip closely conforming to that of the fault-plane. Other examples might be given, but the above will sufficiently illustrate the general character.

At first I regarded them as a result of the faulting, produced by friction along the fault-plane; but further observation led me to the opinion that they preceded, and determined the location of, the faults. I was first led to this opinion by finding a fold, much like fig. 1, finely exposed in the line of a small fault at one end, where the displacement had diminished it little or nothing.

Other reasons for so thinking are, 1°, that, although of such general occurrence in connection with the faults as to suggest a very important relation between the two, they are not dependent on the faults, since

they occur abundantly out of the vicinity of faults; 2°, that the fault-plane, wherever exposed, shows such a dip (about 45°) as it would naturally have if determined by one of the angles of the fold; 3°, that the angles of the flexure form a line of least resistance, along which displacement would certainly occur, did any force tend to produce it; 4°, that numerous indications in this region point to great superficial tension.

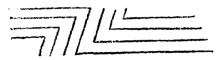

FIG. 1.

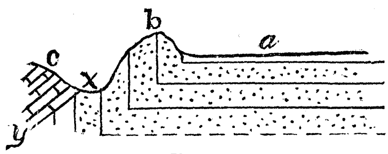


FIG. 2.

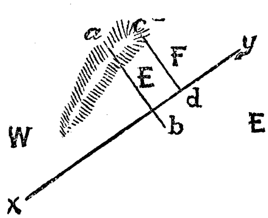


FIG. 3.

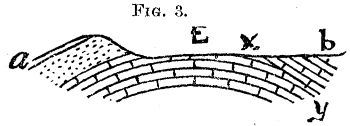


FIG. 4.

I think all of the above reasons will sufficiently explain themselves except the last, in illustration of which I give a very interesting section occurring in the region known as New Garden, in Russel county.

In the plan, fig. 3, $x\,y$ is the line of Clinch-Mountain fault, from which a short fault, $c\,d$, goes off at right angles, on one side of which, *F*, the coal-measures are nearly horizontal and undisturbed. On the other side the strata are pressed into a fold, as shown in the section, fig. 4, where $x\,y$ is the fault-plane; *E*, the subcarboniferous limestone; *b*, the Knox limestone; and *a*, the coal-measures forming the crest of a lofty mountain.

There are no signs of igneous action along any of the faults, unless the evidences of ancient thermal springs along the line of Walkers Mountain fault be so regarded. These indications are, 1°, the band of gypsum, which for many miles skirts the fault on its south-east or upthrow side, at a distance of about a half or three-fourths of a mile from the fault-line (it is the same as that mentioned by Mr. Bien in *Science*, April 18, but does not, as he seems to surmise, enter Burk's Garden, which is some distance away on the opposite side of the fault); 2°, the Saltville basin, the bottom of which is, by estimate, not less than two hundred feet below the bed of Holston River, the excavation of which in the limestone must be accounted for by other agencies than ordinary river-erosion; besides, its structure is such as to render it improbable that it ever formed a portion of a river-valley.

In conclusion, if there were, as assumed, an increase of tension by lateral pressure toward the surface, disturbances of strata would begin near the surface, resulting in sharp folds of the character described, which, in turn, would determine the locality of the faults, the tendency of which would be to extend progressively downward. G. H. SQUIER.

Trempealeau, Wis., May 10.

### Assumptions of museum-keepers.

In Mr. Goode's interesting summary of 'The exploring voyage of the Challenger,' I notice a paragraph that merits attention. Recalling the fact that the deep-sea fishes have been in Dr. Günther's hands 'now eight years,' and lamenting the delay in publishing the results, he very justly says, that "the preliminary descriptions published in 1878 are so meagre as to be nearly useless to any one except their author," and immediately adds, that "the type specimens themselves will, *of course*, be inaccessible for comparison until the final report is in type" (*Science*, iii. p. 580). Had it not been for private information with which I had been favored, I might have supposed that the concluding paragraph was an example of what has been called 'heterophemy,' and that my excellent friend had intended to say that the type specimens themselves will, *of course*, be accessible for comparison. It was, however, with the greatest astonishment that I learned, some months ago, that access had been denied to the collection in question by Dr. Günther, and that, for instance, an eminent and accomplished European ichthyologist, on a visit to England, had been refused the *right* of examination. I say advisably *right* rather than *privilege*; for I had always believed that the British museum was a *public* institution, supported by liberal grants from the nation, and created to facilitate and promote scientific investigation, and *not* intended for personal aggrandizement, or to uphold any officer in petty spite. On what possible ground can Dr. Günther withhold the opportunity for examination of any specimens in his keepership to any competent naturalist? It may be conceded, *causâ argumenti*, that he has a right to name any specimens, and, at any rate, the matter is of too small moment to question at present; but I do not know on what principle he can withhold a sight of any specimen for a day even. A naturalist has, doubtless, a right to keep his own collection, bought with his own money, secluded, and to deny the privilege of examining a specimen to any one, although I have more than once heard such a procedure designated by the forcible and expressive, even if inelegant, word, 'hoggish;' but such action is worse than illiberal, and becomes criminal, in the case of a public officer. It is criminal because it is a breach of trust; for the custodian is a keeper, employed and paid by the government to care for the collections amassed for the people. Denial of the opportunity to examine such collections, under proper restrictions, may also, as intimated by Mr. Goode, result in the direct retardation or suppression of scientific activity. If Mr. Goode and my private information are correct in fact, the policy of the British museum, as interpreted by at least one of its officers, is petty, selfish, hindering to science, and subversive of public trust, or the officer exercising such powers is criminal in monstrous usurpation of delegated authority. In any event, a protest is called for; and I, for one, do make protest against such and all similar restrictions. While constant clamor is made, in the nominal interest of 'science,' for appropriations to advance scientific investigation, we may at least demand that the trustees for handling such appropriations shall not become barnacles to prevent its healthy progress. THEO. GILL.

Washington, May 10.

### Hibernating mammals.

An article on hibernating mammals, by Dr. C. C. Abbott, in *Science*, No. 65, contains several statements the correctness of which I am inclined to challenge. For example: Dr. Abbott says, "Of the thirty or more mammals found here [central New Jersey], thirteen species are supposed to be hibernating animals. These are four species of bats, two of moles, three squirrels, one ground squirrel, one marmot, one jumping-mouse, and one Hesperomys."

If it is true that the red squirrel, 'two moles,' and 'one Hesperomys' hibernate in the latitude of central New Jersey, the fact is sufficiently interesting and important to merit a detailed account of the evidence upon which an announcement seemingly so extraordinary and improbable is based.

Further on, the doctor states that the common star-nosed moles "form commodious nests, placing a good deal of fine grass in them. Here, indifferent to freshets, they remain all winter, and, as they can lay up no food, sleep, I suppose, through the entire season. The fact that these moles are unaffected by being submerged during the spring freshets is an interesting fact." Here, it will be observed, the author not only asserts that the star-nosed moles 'remain all winter' in their nests; but, without adducing a single fact in proof, he even goes so far as to assume that they are 'submerged during the spring freshets,' and goes on to say, "I think that the animals must have been thoroughly soaked for from forty-eight to seventy-two hours, the ordinary duration of the high water." Now, it is a very easy matter for these semi-aquatic animals to betake themselves to higher ground when driven from their usual haunts by freshets; and this is exactly what usually takes place, as I have ascertained by personal observation.

In the Adirondack region, where snow covers the ground for five or six months of the year, the star-nosed mole does not hibernate. At the approach of winter, it sinks its galleries below the depth to which frost penetrates, and still finds an abundance of earthworms, which at all seasons constitute a large share of its food. When the snow has attained the depth of a metre or a metre and a half, as it commonly does here during January and February, the frost gradually leaves the ground, and both moles and earthworms again approach the surface. The moles sometimes burrow up through the snow; and I have captured them while running about on a stiff crust, through which they were unable to bore in time to make good their escape.

The red squirrel is well known to be the hardiest of his family. Disdaining to hibernate, he remains active throughout the continuance of excessive cold. When fierce storms sweep over the land, he retires to his nest, to re-appear with the first lull in the wind, be the temperature never so low. I have frequently observed him when the thermometer ranged from 30° to 40° below zero, Centigrade, but could never see that he was troubled by the cold. While running on the snow, he often plunges down out of sight, tunnels a little distance, and, re-appearing, shakes the snow from his head and body, whisks his tail, and skips along as lightly, and with as much apparent pleasure, as if returning from a bath in some rippling brook during the heat of a summer's afternoon.

Dr. Abbott, after commenting upon the fact that the jumping-mouse (Zapus Hudsonius) lays up no store of provision for winter, while the white-footed mouse (Hesperomys leucopus) invariably hoards, says, "However this may be, the fact remains that both these rodents are quite sensitive to cold, and hibernate as soon as winter sets in; yet how very differently is this faculty exercised!"

The white-footed mouse is the last animal of which I should say, 'sensitive to cold.' Like the red squirrel, it is one of the hardiest of rodents, and in our northern forests it remains active throughout the long and severe winters. It is not known to hibernate; and, except during very stormy weather, its footprints can always be seen, dotting the snow in various directions.

If animals that are active in winter throughout the north-eastern part of the United States and much of British North America should be found hibernating in a mild climate like that of central New Jersey, the fact would be of unusual interest; but, since its acceptance must upset the well-known laws that govern the physiological process of hibernation, it becomes expedient to sift well the evidence upon which such statements rest. C. HART MERRIAM.

### Experiments with reflections.

The accompanying figures, though not perfectly accurate copies of photographs I have made, are at least truthful representations of reflections obtained from, 1°, rectilinear striations upon a polished plane; 2°, circular striations upon a disk; 3°, circular striations upon a sphere.

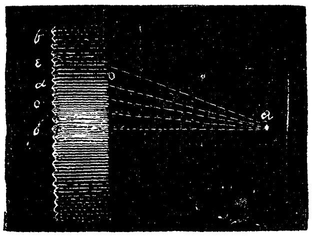

FIG. 1.

In fig. 1 the direct rays from a luminous point, $a$, touching the rectilinear striations at $b$, return to the eye a brilliant reflection of the luminous point; the divergent rays at $c$, $d$, $e$, $f$, returning the same with decreasing brilliancy as the remoter striations are reached. Thus a band of light is reflected perpendicular to the striations, of uniform transverse diameter, and with an intenser luminosity at the central point. If the striations are upon a finely polished surface, the outline of the luminous point is preserved in the reflection quite sharply, whether circular or otherwise.

If the striations are circular and concentric from circumference of a disk, — the centre of the disk, the light, and the eye occupying the same plane, and the face of the disk perpendicular to it, — the reflection is two equal sectors, with their luminous apices united at the centre of the disk, as in fig. 2. The diameters of the intercepted arcs depend upon the angle formed by the incident and reflective rays. Variations of the light, disk, or eye, in position, produce every degree of difference between the two sectors.

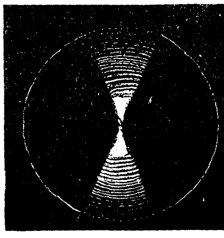
FIG. 2.

If the striations are upon a polished sphere, and

are parallel with its equator, the axial extremities become well-defined poles.

Place the equator of the sphere, the light, and the eye, in the same plane, and the axis of the sphere vertical to it. Make the reflective angle as acute as possible. The reflection is a central luminous point


Fig. 3.


Fig. 4.

at the equator in a vertical band terminating acutely toward either pole, fig. 3. If the reflective angle is about 90°, the reflection is crescentic, fig. 4. When the sphere is placed remote from the light and the eye, with its axis inclined toward the light, the reflection is a luminous point at its proximal pole, fig. 5.

If the sphere is brought nearer the light, thus increasing the reflective angle, a short curved tail de-

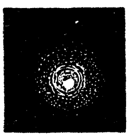
Fig. 5.

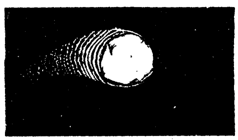
Fig 6.

velops, fig. 6. This increases in length as the sphere is approached to the light, until, at close proximity, *a*, in fig. 7, results. Removal of the reflecting surface at any latitude on the sphere interrupts the reflection, as at *c*, fig. 7. The interposition of a comparatively small opaque body before the light, when the inclined sphere is in *very* close proximity to the light, divides the reflection, — *a*, *b*, fig. 7. Multiple sources of light multiply the reflections, which describe different curves, all radiating from, though not always reaching, the pole. The greater the sphere in relation to the source of light, the more perfectly the form of the luminous point is reflected. If circular, it appears as a disk or brilliant nucleus. The extension of the reflection toward the equator constitutes a diverging train or tail.

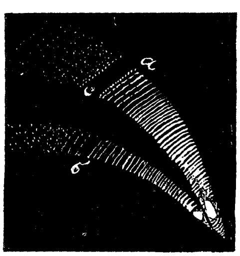

Fig. 7.

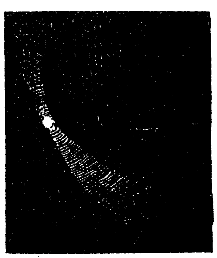
Fig. 8.

Changes in the positions of the three factors produce a limitless variety of figures, which are suggestive of various cometic forms: for instance, fig. 8, two opposite spherical sectors, the analogue of figs. 1 and 2. The resemblance of the reflections to cometic appearances is increased if the striated reflecting sphere, with the inclined axis maintained, is made to describe about a light approximately the form of a comet's orbit; then all the changes exhibited by a comet, from the first nebulous point to the fully-developed tail, are illustrated upon its surface, including the changes in the position of the tail in relation to the light, which occur during the small curve of a comet's orbit. The reflections describe all the radii between *a* and *b*, fig. 9. It is surprising to what extent cometic behavior may be illustrated upon the polished spheres: position, elongation, abbreviation, disappearance, annular images, irregular images, are all quite possible.

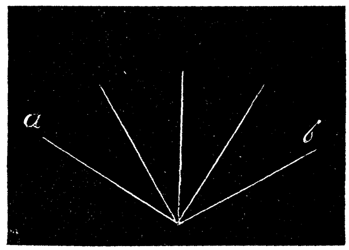

Fig. 9.

If an hypothesis may be ventured, it is briefly this: if a sphere of meteoric dust of a diameter exceeding the greatest length of the comet's train, having an axial rotation and inclination, does actually traverse the comet's orbit, such a rotation would convert its superficial inequalities, varying densities, and possibly its individual atoms, in effect, into continuous striae, parallel with its equator; and such inclination would place it in position to reflect the images which comets display. Discussion of the hypothesis is reserved. Geo. O. Williams, M.D.

Greene, N.Y.

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## *THE BIOLOGICAL INSTITUTE AT PHILADELPHIA.*

Not a few of the readers of *Science* are looking upon the new departure in biology in Philadelphia with high hopes that it may become one of our most valued possessions. They regard it as a new and therefore great opportunity. But they will be sadly disappointed if its officers give themselves up largely to merely routine teaching, or are satisfied in taking a position towards biological science in any large degree conservative. The United States is a poor field, or is rapidly becoming so, for the perpetuation of ancient methods in one of the youngest and most vigorously growing of the sciences. And if any one cares to profit by experience, let him reflect upon those steps, which, within ten years, have led up to one of our most valued institutions, — the Johns Hopkins university, — or to the almost incredible success of the Naples station. Broadly speaking, their conditions of prosperity have been two, — on the one hand, money;

on the other, methods. A firm financial basis is always absolutely indispensable; and this, we understand, the new department is to have in abundance. The second requisite is equally imperative. The university just now mentioned had abundant means; so had others before it: but it invoked new methods. True, these seemed to some, at the outset, revolutionary; but who can deny that they have been a success? It was because of this great importance of absolute freedom that some felt it to be safer for the new establishment in Philadelphia to steer clear of affiliations, however exalted; and it was for this reason alone. The advantages accruing to both the University of Pennsylvania and the biological institute (or department), by union, are too obvious to need discussion; and both are to be congratulated, provided only that that liberty be granted which will insure the employment of the best methods.

As to the exact line of work to be done, or the methods to be set going, we may safely trust to the discretion of the new faculty. Evidently, museum-work in the older sense, and elementary teaching by the older methods, may be neglected. And it will very likely be found true that great opportunities are embraced in the hunt for new methods of work, — in technique, — and especially in field-work at the sources of supply. The American mind is quick, inventive, ingenious. Must it always go abroad to get new 'points'? Let it, rather, come to prove its ingenuity by original biological methods at home; then, with application of these at the sources of supply, — at the laboratory table, by the shores of the sea, by the river or the gulf, — we may solve those home problems which are most pressing. It is not too much to say that the eyes of the biologists of Europe are upon us and upon our material. Moreover, if, as is certain, the field is white for the harvest, need the reapers be few? or those few, Europeans?

And let us by no means forget our greatest opportunity. In the variety of our environments, and in the area of our country, we have conditions highly favorable for the study of those final broader physiological problems which must eventually be the key to life-science as a whole. We wish the new biological department every possible success.

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## *THE ENEMIES AND PARASITES OF THE OYSTER, PAST AND PRESENT.*

AMONG the worst enemies of the oyster of our Atlantic coast are the star-fishes; and great numbers of them are usually found upon all oyster-beds, where they are committing depredations upon the mollusks. It is an interesting fact, however, that the remains of star-fishes are rarely found in connection with fossil oysters of any age, not even with tertiary oysters. The oyster family culminated in the cretaceous period, as regards generic differentiation. The abundance of individuals was also as great then as it has ever been since; and it is often the case that the remains of oysters are found in great profusion in both cretaceous and tertiary strata. The cretaceous strata of Texas have furnished a great abundance of the Ostreidae of every generic and subgeneric form known upon this continent; and yet, among all the many collections of fossils from those rocks which I have examined, I have never seen a fragment of a star-fish, although echinoids in considerable variety are not uncommon.

Star-fishes very closely related to those now living upon our coast have been reported by Forbes from Jurassic strata, and I have recognized a similar form from the Neocomian of Brazil; but we have no evidence that star-fishes of any kind were ever a serious enemy to the oyster before the present epoch. The ancient star-fishes, no doubt, had the same propensities that their modern representatives have; but they seem not to have obtained that preponderance then which they have since acquired.

Burrowing sponges similar to, if not identical with, the living Cliona, are of very ancient origin. The fossil shells of the ostreid genera Exogyra and Gryphaea, as well as those of Ostrea proper, are as commonly and completely 'riddled' by burrowing sponges as are any shells of the living oyster. Indeed, it is rare to find even a small collection of fossil oyster-shells free from such burrows. Other fossil shells besides those of the Ostreidae are found to have been thus infested, the burrows being in all respects the same as those which infest the oysters.

Not only did Cliona exist abundantly with the Ostreidae of mesozoic time, but I have obtained evidence that it also existed in paleozoic time in essentially the same character that it has to-day. Several years ago I obtained from the Devonian strata of Iowa some shells of the brachiopod genus Strophomena, which contain numerous Cliona-like burrows. These I submitted to Prof. A. E. Verrill, who informed me that in his opinion they are the borings of a species of Cliona.

C. A. WHITE.

## A MOUND OF THE KANAWHA VALLEY.

A MOUND recently opened by Col. P. W. Norris, one of the assistants of the Bureau of ethnology, presents some facts of more than ordinary interest. It is situated on the farm of Col. B. H. Smith, near Charleston, W. Va., is conical in form, about a hundred and seventy-five feet in diameter at the base, and thirty-five feet high. It appears, in fact, to be double; that is to say, it consists of two mounds, one built on the other, the lower or original one being twenty feet, and the upper fifteen feet, high.

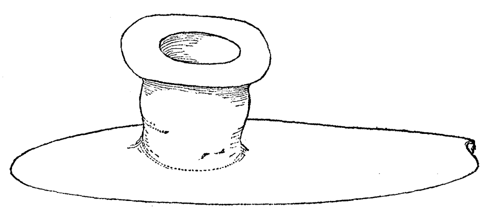
The exploration was made by sinking a shaft twelve feet square at the top, and narrowing gradually to six feet square at the bottom, down through the centre of the structure, to, and a short distance below, the original surface of the ground. After removing a slight covering of earth, an irregular mass of large, rough, flat sandstones, evidently brought from the bluffs half a mile distant, was encountered. Some of these sandstones were a good load for two ordinary men.

The removal of a wagon-load or so of these stones brought to light a stone vault seven feet long and four feet deep, in the bottom of which was found a large and much-decayed human skeleton, but wanting the head, which the most careful examination failed to discover. A single rough spear-head was the only accompanying article found in this vault. At the depth of six feet, in earth similar to that around the base of the mound, was found a second, also much-decayed, skeleton, an adult of ordinary size. At nine feet a third skeleton was encountered, in a mass of loose, dry earth, surrounded by the remains of a bark coffin. This was in a much better state of preservation than the other two. The skull, which was preserved, is of the compressed or 'flat-head' type.

For some three or four feet below this, the earth was found to be mixed with ashes. At this depth, in his downward progress, Col. Norris began to encounter the remains of what further excavation showed to have been a timber vault, about twelve feet square and seven or eight feet high. From the condition in which the remains of the cover were found, he concludes that this must have been roof-shaped, and, having become decayed, was crushed in by the weight of the addition made to the mound. Some of the walnut timbers of this vault were as much as twelve inches in diameter.

In this vault were found five skeletons, — one lying prostrate on the floor at the depth of nineteen feet from the top of the mound, and four others, which, from the positions in which they were found, were supposed to have been placed standing in the four corners. The first of these was discovered at the depth of fourteen feet, amid a commingled mass of earth and decaying bark and timbers, nearly erect, leaning against the wall, and surrounded by the remains of a bark coffin. All the bones, except those of the left fore-arm, were too far decayed to be saved: these were preserved by two very heavy copper bracelets which yet surrounded them.

The skeleton found lying in the middle of the floor of the vault was of unusually large size, "measuring seven feet six inches in length, and nineteen inches between the shoulder-sockets." It had also been enclosed in a wrapping or coffin of bark, remains of which were still distinctly visible. It lay upon the back, head east, legs together, and arms by the sides. There were *six* heavy bracelets on each wrist; four others were found under the head, which, together with a spear-point of black flint, were incased in a mass of mortar-like substance which had evidently been wrapped in some textile fabric. On the breast was a copper gorget. In each hand were three spear-heads of black flint, and others about the head, knees, and feet. Near the right hand were two hematite celts; and on the shoulder, three large and thick plates of mica. About the shoulders, waist, and thighs were numerous minute perforated shells and shell beads.



STEATITE PIPE FOUND NEAR CHARLESTON, W. VA.

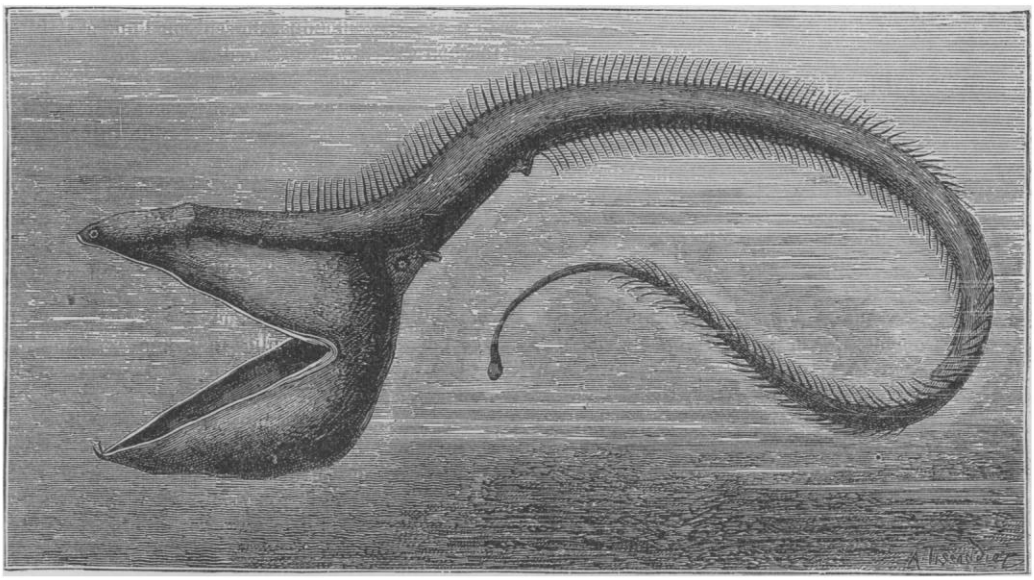
The gorget is precisely of the pattern represented in fig. 12, p. 100, Fifteenth report of the Peabody museum. The bracelets are very heavy, and, like the gorget, have the appearance of having been hammered out of native copper.

While filling up the shaft, Col. Norris discovered, in the dirt which had been removed from it, a steatite pipe, represented in the accompanying figure. It is worthy of note, that this pipe is precisely of the form of some found recently in the mounds of western North Carolina, and agrees exactly with the description, given by Adair, of pipes made by the Cherokees.

CYRUS THOMAS.

## *THE ICHTHYOLOGICAL PECULIARITIES OF THE BASSALIAN FAUNA.*[1]

THE author recalled the fact that he had recently proposed the name 'Bassalian realm' for the collective deep-sea faunas. At indefinite distances below the surface, deepest in the tropics, we find strange forms of animal life, which differ not only specifically and generically from those of the superincumbent water, as well as from those of the cold extremes of the globe, but often represent quite distinct families. Those forms which live at moderate depths (existing, as they do, in cold water) are related to, or even belong to, the polar faunas; but, as we go still deeper, we find various other assemblages of animals. Those of the lowest horizons are often wonderfully modified; and the deep-sea explorations of recent years have brought to light many very peculiar forms. Not the least remarkable of the several animal types, and in some respects the most remarkable, are the fishes. The only extended summary of our knowledge of the fishes of the deep sea has been given by Dr. Günther, in his 'Introduction to the study of fishes' (pp. 296–311). According to Dr. Günther, "before the voyage of H. M. S. Challenger, scarcely thirty deep-sea fishes were known. This number is now much increased by the discovery of many new species and genera; but, *singularly, no new types of families were discovered:* nothing but what might have been expected from our previous knowledge of this group of fishes" (p. 304). Dr. Günther evidently forgot that he had himself proposed to distinguish a peculiar family (Bathythrissidae) for a deep-sea fish obtained by the Challenger; and his generalization otherwise will not bear the test of confronting with the facts known even to him, much less those now known. In fact, the deep-sea fauna is surprisingly rich in peculiar forms of fishes; and no less than twenty-eight families are either confined entirely to the deep sea, or represented elsewhere by mere stragglers. Three new family types were obtained during the past year. Further, two orders, the Lyomeri and the Carencheli, are only known from deep-sea representatives. The families that have been already distinguished for the deep-loving fishes are twenty-eight in number.[2] Several of these have been



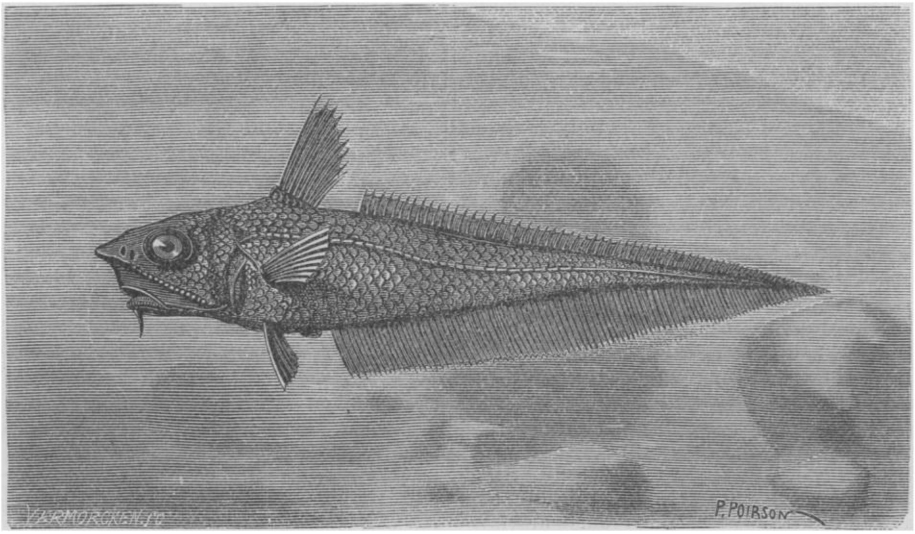
EURYPHARYNX PELECANOIDES.

[1] Abstract of a paper by Dr. THEODORE GILL, read to the National academy of sciences, April 17, 1884.

[The investigations carried on in connection with the French exploring-vessel Le Travailleur appear to confirm, as well as supplement, the results heretofore attained. Some of the new species have already been illustrated, and we here introduce figures of representatives of three of the most characteristic of the deep-sea types. These are Eurypharynx pelecanoides (the type of the family Eurypharyngidae and order Lyomeri), Macrurus australis (a form of the widely distributed and rich family Macruridae), and Melanocetus Johnsoni (a representative of the deep-sea pediculate family of Ceratiidae). Additional figures will be found in another article in this number. — ED.]

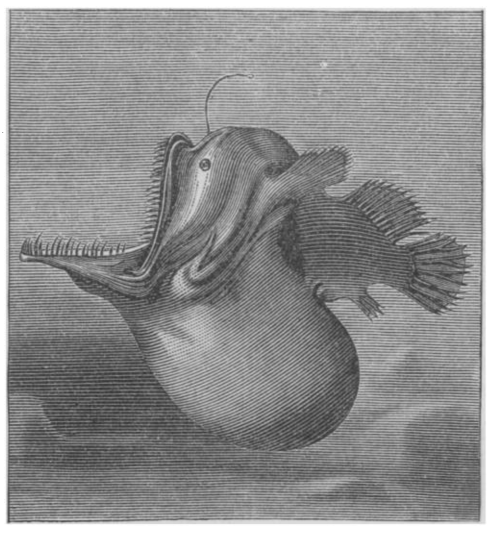
[2] Saccopharyngidae, Eurypharyngidae, Synaphobranchidae, Simenchelyidae, Nemichthyidae, Derichthyidae, Notacanthidae, Ipnopidae, Chauliodontidae, Stomiatidae, Paralepididae, Alepi-

greatly increased of late. Probably other families require to be differentiated for certain




MACRURUS AUSTRALIS.

peculiar forms; and, of course, numerous families, known from littoral fishes, have deep-sea representatives. It is obvious, then, that we have, in such an aggregate, a combination of forms very different from any of the superficial faunas we have heretofore considered. We will be justified, therefore, in recognizing for them a special realm, which has been called 'Bassalia' or the 'Bassalian realm.' But caution is timely that it seems to be rather a heterogeneous one, and may hereafter require restriction. The data now available are insufficient, however, for differentiating what are, doubtless, the several constituents or regions of this realm.



MELANOCETUS JOHNSONI.

Dr. Günther has even expressed the opinion, that (Introduction. p. 304), "as far as the observations go at present, no distinct bathymetrical regions which would be characterized by peculiar forms can be defined," and that, "if the vertical range of deep-sea fishes is actually as it appears from the Challenger lists, then there is no more distinct vertical than horizontal distribution of deep-sea fishes" (*op. cit.*, p. 305). There are reasons for believing that these generalizations are at least exaggerated; but it may be well to await the collection of more material, and the collation of more extensive data, before reversing them. Four factors must determine the bathymetrical distribution of fishes: (1) temperature, (2) the decrease and final absence of light, (3) the concomitant paucity or absence of vegetation, and (4) the pressure of the water. The relative importance of these several factors still remains to be studied, and their results discriminated. The absence of vegetable life confines the animal life to car-

sauridae, Alepocephalidae, Bathylagidae, Halosauridae, Bathythrissidae, Regalecidae, Trachypteridae, Lophotidae, Chiasmodontidae, Stephanoberycidae, Berycidae, Grammicolepididae, Polymixiidae, Lycodidae, Brotulidae, Macruridae, and Ceratiidae.

nivorous forms; and many of the fishes are pre-eminent for formidable armature, and some for extraordinary modifications for obtaining food.

## SMITH SOUND, AND ITS EXPLORATION.

A MORE opportune moment could not have been selected by Dr. Bessels for publishing[1] a condensation of the literature relating to Smith Sound. Added to the interest which arctic narrative has always possessed, is the concern felt for Lieut. Greely and his party, and the hopes and fears awakened by the departure of the expedition for his relief. Many persons will therefore be glad to learn something of the region, which, with all its terrors and hardships, has been sufficiently attractive to again and again induce men to risk life and limb in the attempt to penetrate its mysteries. For that class of readers, Dr. Bessels' paper was, possibly, originally designed. But in relating the history of the more recent expeditions, especially those carried on under the auspices of the signal-office, the author has been so severe in his criticisms and reflections, that his production, while possessing the faults, has likewise the interest, of a polemic. Paragraphs like the following will certainly not fail in attracting attention for want of severity. "This plan, termed the Howgate plan, was devoid of all sound originality. The valuable parts of it are based on the work of Hayes and Weyprecht; the rest, emanating from the brain of Lieut. Henry W. Howgate, bears testimony that the originator of the '*Howgate plan*' was not familiar with even the rudiments of arctic exploration" (p. 414). "Lady Franklin Bay should have been the last place chosen as a permanent or temporary station" (p. 416). "That this plan [Howgate or Signal-service plan] would lead to disaster was pointed out by myself and others at an early date; but the judgment of the chief signal-officer in arctic matters was considered supreme, and upon him rests the responsibility of its failure. Several names connected with the signal-office will not easily be forgotten in arctic history" (p. 418). "The Proteus is now at the bottom of the sea; and all the arguments I could offer would not be able to raise her, or to relieve the ice-bound party in Lady Franklin Bay. The person responsible for the disaster is the chief signal-officer" (p. 435). "The preceding paragraph embodies the substance of his (Garlington's) instructions, as given and signed by W. B. Hazen, Brig. and Bvt. Maj. Gen'l, chief signal-officer, U. S. A." (p. 431). "It clearly shows that those who wrote Garlington's orders were utterly ignorant of the nature and character of the country to be traversed" (p. 436).

Other quotations might be made, which would show that the signal-service is not alone censured. The explorations of Sir John Ross and Hayes, and the conduct of Buddington, are all criticised more or less severely. Ross and Hayes are dead, and can make no reply; Buddington, according to Bessels, is not proficient in the art of writing, and we can expect nothing from him. But Gen. Hazen has a pen, which he has at times used with considerable effect; and it is possible that he may see fit to raise the low temperature of the present controversy to a height not at all in accordance with the normal of arctic literature.

But, on the whole, the strictures upon the signal-service expeditions appear to be just and proper. The folly of intrusting the organization and details of an arctic exploring-party to a board composed of persons without special experience, has been forcibly brought to notice by the failure of both relief expeditions; and possibly it will be made more prominent when we know more of Lieut. Greely's situation and experiences. That such a board should advise many unwise things, and propose schemes and plans more or less impracticable, was in the nature of things. But that success should be expected from nautical expeditions to the polar seas, which were commanded by persons not only without arctic experience, but ignorant of the art of navigation and the management of ships, seems incredible. Certainly Greely's party, as well as those undertaking his relief, should have had the benefit of the best arctic and nautical experience, assistance, and advice. That they did not have it is evidently the fault of the originators of the Lady Franklin Bay plan, and the devisers of the details of its execution.

But, while careful to point out the errors in origination and execution of the signal-service expeditions, Dr. Bessels appears to entirely overlook the fact that the Polaris expedition, of which he was a member, was so constituted as to invite, if not insure, failure. Hall, its commander, though of great arctic experience, was entirely ignorant of ships, their management, navigation, and capabilities. He was also entirely an uncultivated man, and little fitted to observe or study phenomena in their scientific aspects. His sole qualification for the direction of a polar expedition was his enthusiasm and interest in arctic exploration. To supply his deficiencies, the Polaris party was peculiarly organized. The care and management of the ship were in the hands of Buddington. The scientific corps was under the direction of Dr. Bessels. Hall was to supply the steam necessary to run this rather complicated machinery. Naturally, from such an organization, continual controversy was to be expected; and controversy, under the circumstances, would necessarily seriously affect the success of the undertaking. But the instructions issued by the Navy department provided, that, in case of Hall's death, the control of future operations should be shared by Buddington and Bessels; the former being supreme as far as the vessel was concerned, the latter equally supreme in the direction of matters on shore. Such a provision could but tend to a failure in all respects. During Hall's life the possibilities were, that either scientific observations would be sacrificed to the supposed interests of the vessel, or that the real interests and safety of the vessel would be sacrificed to a supposed necessity for

[1] Proceedings of the U. S. naval institute, vol. x., no. 3.

making additional scientific observations. The most likely course to be pursued would be the subordination of both science and safety to Hall's dominant motive, — the desire to reach a high latitude. In the event of his death, the foregoing possibilities would become probabilities, if not actual certainties. It should never be forgotten, when attempting to determine the relative values of the organizations of the several polar expeditions, that the success of the Polaris was entirely due to unprecedented good fortune, and not at all to good management, or extraordinary judgment in encountering and overcoming obstacles. Had serious difficulties occurred at the outset, for instance such as the English expedition had to contend with, it is probable that geographical knowledge would not have been advanced to any important extent.

The principal defect to be noticed in Dr. Bessels' paper is a want of appreciation of the laws of literary and historical perspective. Quite unconsciously, perhaps, he exaggerates the importance of events with which he was personally associated. As an instance, the narrative of the Polaris' voyage is detailed at extraordinary length, occupying some thirty pages of the paper; while the history of the late English expedition, by far the most important of all, occupies but fourteen pages. In fact, an ice-hummock seen by the Polaris appears to be of more consequence than an iceberg seen from any one vessel; and an oath of Buddington's more worthy of chronicle than the most animated descriptions of Kane, Hayes, or Nares. This is a very serious fault in an historical writer, and cannot be too severely reprehended. Generally speaking, it tends to render the style of the publication undignified, and the substance trivial. But it is only fair to remember that Dr. Bessels is writing of circumstances of an exceptional nature; that he is relating much that is new, and which to most persons is rather secret than general history; that he was intimately and prominently connected with the events of which he writes; and that the facts have not, heretofore, been presented from his particular point of view. The faults of the paper are therefore excusable, while the merits would counterbalance them even were they not. The history of two hundred and sixty years of arctic exploration, so far as it relates to Smith Sound, has been condensed into a volume of a hundred and fifteen pages, accessible to any one. The voyages of the various discoverers, beginning with Baffin and Bylot, and ending with Garlington, have been analyzed with a care that indicates the expenditure of considerable labor. The result will be a better appreciation of the work of the older navigators, which Dr. Bessels shows to have been more accurate than was to be expected, and strongly contrasting with that of some of their successors, notably Dr. Hayes. Indeed, considering the light thrown on the geography of this region by the observations of the Polaris, Nares, and Proteus expeditions, it is very difficult to understand how Dr. Hayes could have asserted the existence of the open polar sea. But Dr. Bessels has shown how it was possible for the mistake to be made. In his opinion, and he brings strong evidence to support it, Hayes never reached a latitude above 80°. If this be true, then we can understand why Hayes, looking, as he must have done, across Kane's basin, should have imagined that he saw an open sea. No other plausible explanation can be given; for, had he been north of Cape Collinson with an atmosphere sufficiently clear for observations, he could not have failed to see the opposite coast of Greenland, only thirty miles distant.

In discussing the scientific results, Dr. Bessels might have gone more into detail without fear of incurring displeasure, for the scientific results are the most valuable products of the various arctic expeditions. He is of the opinion that the general set of the currents is to the southward, and that there are no data supporting the theory of an extension of the Gulf Stream to these high latitudes. He calls attention to the fact that the ice met by the Polaris was of a different character from that encountered by the English expedition, and points out the causes which would prevent the latter formation from being continuous. He says, "There is no reason to assume that the ice-cover of the sea in close vicinity to the north pole should be more dense and impenetrable than its lower latitudes." He is also of the opinion that land in some shape exists to the northward of Markham's highest position, basing his opinion upon the soundings and character of the ice in that latitude. This latter assumption may or may not be true; but it will not, in all probability, be removed from the domain of hypothesis for some time to come.

Finally, Dr. Bessels does not consider Greely's situation as dangerous, and is of the opinion that the party remained at Lady Franklin Bay during the past winter, and will be found in the vicinity of Littleton Island about the end of June. He adds some advice regarding the conduct of the relief expedition, which appears judicious; and, considering the experience of the author, it should have great weight.

The impression left after reading the paper, while not exactly prejudicial to arctic expeditions, is certainly opposed to them as some have been heretofore constituted. Their value really lies in the opportunity they afford scientific observers to study phenomena out of the usual range. Unfortunately this end has always been subordinated to a desire to reach the north pole, or an effort to rescue those who had gone forth on that rather barren quest. Without doubt, had not most arctic expeditions been animated by those dominant motives, the results would have been of far more consequence. Certainly future expeditions should be guarded against the operation of similar influences.

## *THE DEEP-SEA FISHES COLLECTED BY THE TALISMAN.*[1]

IN the cruises made by the Travailleur, the exploring-instruments left much to desire, and the taking of fish was so rare, that, as Mr. Milne-Edwards said

[1] Translated from an article by H. FILHOL in *La Nature*.

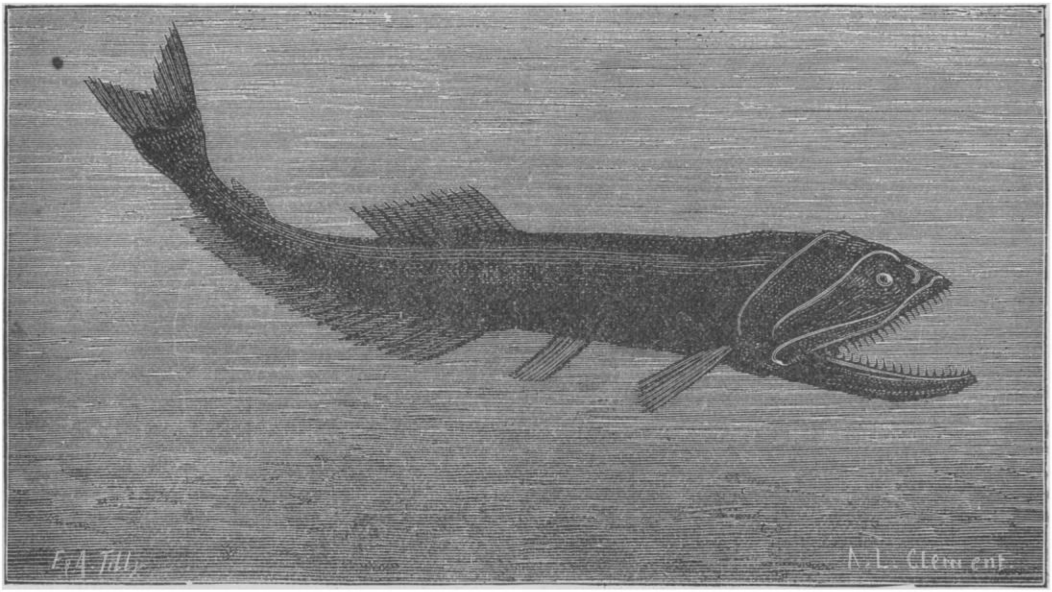


FIG. 1.—NEOSTOMA BATHYPHILUM.

in his report, the capture of one of these creatures 'was considered really an event.' During the cruise of the Talisman, thanks to that new invention, the trawl, they were taken more frequently. Almost all the dredgings resulted in the capture of some fish, and sometimes the number brought up was surprising. For instance: on the 29th of July, in latitude 16° 52′, longitude 27° 30′, in one drag of the trawl, 1,031 fishes were taken, at a depth of 450 metres.

The most interesting surface fishes taken were a large shark, and a fish of small size peculiar to the Sargasso Sea, Antennarius marmoratus Bl. Sch. Sharks (Carcharias glaucus) were found especially between Senegal and the Cape Verde Islands. They followed our ship in schools, and we often saw them accompanied by their 'pilots,'— fishes known among the ancients as Pompilius, and, by naturalists of the present time, as Naucrates ductor. It seems that Naucrates acts as a guide for the sharks, and that the latter, in recognition of its services, never pursue it. It is certain that the Naucrates which we saw lived in perfect harmony with the sharks. They swam around them, and sometimes leaned against them, within the pectoral fin. These fishes, which much resemble mackerel, are bluish gray, darkening toward the back; broad vertical stripes of a beautiful blue encircle their bodies; the pectoral fins are white, the ventral ones black, while the tail is of a blue shade. We found this species of shark in the Sargasso Sea.

In the midst of the floating vegetation of the Sargasso Sea, the second species peculiar to the surface-water, noticed at the beginning of this article, Antennarius marmoratus, is one of the strangest animals we observed. Its back is furnished with long appendages; and its fins, elongated and broadened at the ends, and digitated, form a sort of feet by means of which it circulates among the seaweed which shelters it. It builds a nest, joining, by means of strong mucous threads, balls of the seaweed on which it deposits its eggs. These balls float, tossed about by the waves; and, when the young are born, they probably find a safe home within. This fish, like all the animals of the Sargasso Sea, crustaceans and mollusks, is of the same color as the Algae: it has, as it were, assumed their livery. The color of the body, spotted with brown and yellow and white, harmonizes perfectly with the surroundings; and it is only by careful scrutiny that it is discovered. It is evident that this similarity in color is to allow the animals easily to conceal themselves, and thus escape their enemies. But, as Mr. Milne Edwards observes, if this livery is a protection to the animals possessing it, it becomes in certain cases a danger for them; for, owing to it, the carnivorous species which have assumed it can very easily approach their prey without fear of being seen.

The fishes from the deep sea taken on board of the Talisman include a considerable number of genera and species. An examination of them discloses a series of general facts of great interest. The first question which is suggested to one who studies them is this: are there genera and species of fishes characteristic of bottoms of certain depths? that is, are different faunas found at one, two, three, four, and five thousand metres? This question may be answered in the affirmative, for the dredgings show that the distribution of certain forms is limited. Many examinations were necessary to reach this conclusion, on account of the strange circumstance that certain species are found at a depth of from 600 to

almost 3,000 metres. Thus a fish showing the same organic structure is capable of living under pressures varying from a half-ton to one and two tons, and even more. It may be asked how it is that there are forms characteristic of certain depths; for, with zones of distribution of so great extent, it would seem that abyssal faunas should remain the same. The explanation of this singular fact is, that fishes which are found at a depth of from 600 to 3,600 metres do not dwell continuously in the same locality: they are travellers, rising and descending in turns into the abysses of the sea; and, when they make these journeys, they go slowly, so that they can endure the slow expansion and contraction. I will notice a few species which have made known to us these wonderful voyages. We found Alepocephalus rostratus between 868 and 3,650 metres, Scopelus maderensis between 1,090 and 3,655 metres, Lepioderma macrops between 1,153 and 3,655 metres, Macrurus affinis between 590 and 2,220 metres; the depth of distribution for these four species varying by 2,782, 2,561, 2,502, and 2,000 metres. I could mention other cases, but those cited will suffice to show that the organization of fishes of certain depths is such that it is capable of sustaining enormous weights without suffering. The structures of the fishes just mentioned have nothing special which attracts attention, and distinguishes them from fishes living near the surface. Their teeth are well developed, this peculiarity showing that they are carnivorous (fig. 1). All fishes which live continuously at a depth greater than 600 metres are carnivorous. This results from the fact, that, with the absence of light, vegetation quickly disappears at the bottom, and consequently all the species which do not rise to within 150 metres of the surface, the point where the last Algae are found, are obliged to hunt for food. Fig. 2 shows a cut of one of these fishes, Macrurus globiceps, whose depth of distribution is between 1,400 and 3,000 metres.

If the fishes which transiently visit great depths do not show peculiarities in form, this is not the case with those which continuously inhabit deep waters. This ought not to surprise us, for the structure of these animals must suffer important modifications before being adapted to these peculiar conditions of life. Various influences act upon these fishes. Light and vegetation are wanting. Beyond a certain depth the temperature of the surrounding water tends to become equalized, and the water in which they live is always calm. The modifications due to these circumstances affect the structure of the tissues, the size of the eyes, the development of the sense of touch, and the color. Moreover, these fishes possess organs which ordinary fishes do not possess. Their function is to emit phosphorescent light, and thus to supply the light which is lacking.

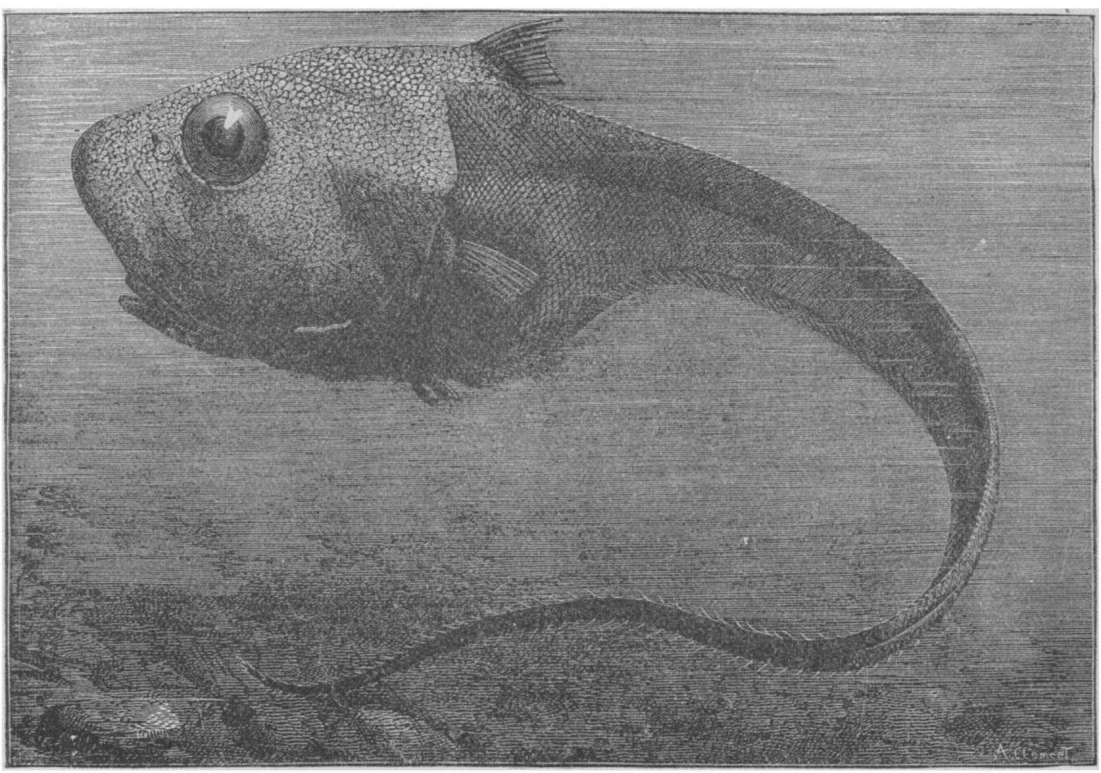


FIG. 2. — MACRURUS GLOBICEPS.

The changes undergone by the tissues are seen in the structure of the skin, muscles, and bones. The skin is thin, and destitute of bright colors, the shades varying from grayish to velvet black (fig. 3). The scales, often much reduced in size, are weakly attached, and the friction which they experience during the ascent of the trawl removes almost all of them. The muscles have little resistance, and, being without flavor, the fish are not edible. The bones are friable, and spongy inside.

In fishes living continuously at a depth to which a little light penetrates, the eyes are quite large in order to present a larger sensitive surface. This fact recalls what we notice in crepuscular birds, whose visual organs are also much developed. Among fishes at a great depth, this increase of the size of the eye is not observed. These organs are of normal size, and possess nothing peculiar, either in their position or structure. Their function in absolute darkness seems at first almost incomprehensible. When, however, one recognizes the fact that these animals possess phosphorescent plates, or, rather, that they are covered by a luminous mucous coating capable of lighting a considerable space, the explanation is found. This phosphorescence serves partly to guide them, and partly to attract prey. It serves, in the latter case, the same purpose as a torch in the hand of a fisherman. This fact has been verified, long since, in the case of surface fishes which hunt at night. Thus Bennett describes a species of shark remarkable for a bright green phosphorescence, which is emitted from the whole lower portion of its body. This learned zoölogist one day brought one of these fishes into a dark room, which was immediately illuminated by its body. The light is increased neither by motion nor by rubbing. After the shark's death, the light from the stomach first disappeared. The jaws and the fins were the last to retain the phosphorescence. The various sharks found only at a depth of two thousand metres, of which several specimens were taken by the Talisman off the coast of Portugal, must, like the fish of which Bennett spoke, use the light which they emit to attract the fishes on which they feed. What is the origin of this mucous coating, which is thus able to shed so bright light? It must be due to the existence of glandular organs, scattered along the sides and the tail, near the eyes on the head, and sometimes more sparsely on the back. But, besides these glandular follicles, certain fishes have apparatus of a quite different kind, which emits light. These organs consist of a sort of biconvex transparent lens, closing externally a chamber filled with transparent liquid. This chamber is furnished with a membrane of black color, formed of

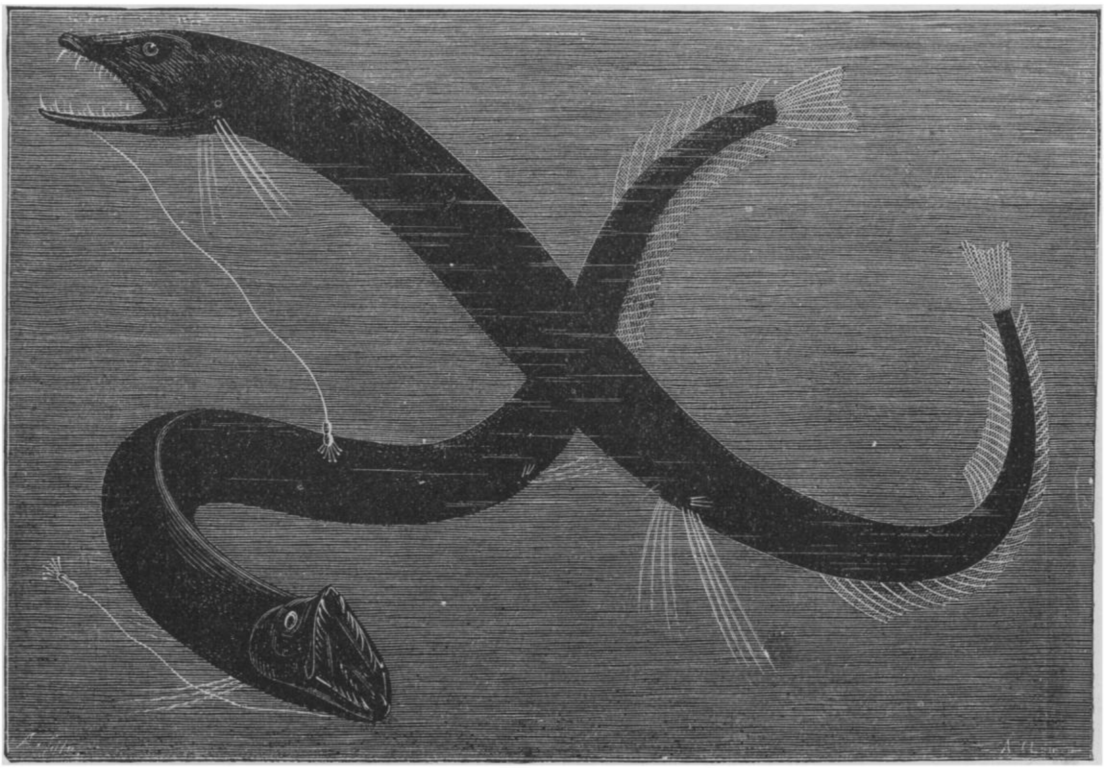


FIG. 3. — EUSTOMIAS OBSCURUS.

little hexagonal cells, much resembling the retina: it is connected with the nerves. These phosphorescent plates are placed either below the eyes, or on the sides of the body. In the Talisman exhibition-rooms, Malacosteus niger (fig. 4) may be seen, caught 1,500 and 2,000 metres below the surface, with enormous plates below the eyes, and Stomias, found at the same depth, with side-plates. Several zoölogists have considered the last-mentioned organs as secondary eyes, in consequence of the retina-like membrane which covers them, and on account of its connection with the nerves. This view is difficult to admit, when the normal development of the eyes is taken into account; and it seems much more reasonable to suppose that they serve simply to produce light, which, owing to the lens in front, may be brought to a focus at a certain point.

The tentacle, which is in continual motion, serves as bait to attract fishes on which it springs. Other very peculiar transformations of the rays of the fins into organs of touch may be seen in various fishes taken on board the Talisman. Bathypterois is especially worthy of mention. Among the most singular tactile organs we noticed in these fishes, that of Eustomias obscurus, immediately below the mouth, is to be mentioned. This new genus is shown in fig. 3. One of the most remarkable peculiarities of fishes living in very deep water is the great development of the mouth and the stomach. In Melanocetus and Chiasmodus, the capacity of the latter organ is such that it can contain prey whose size is double that of the body of the fish. As to the proportions assumed by the mouth, the greatest development is shown by Eurypharynx pelecanoides (see figure, p. 620).

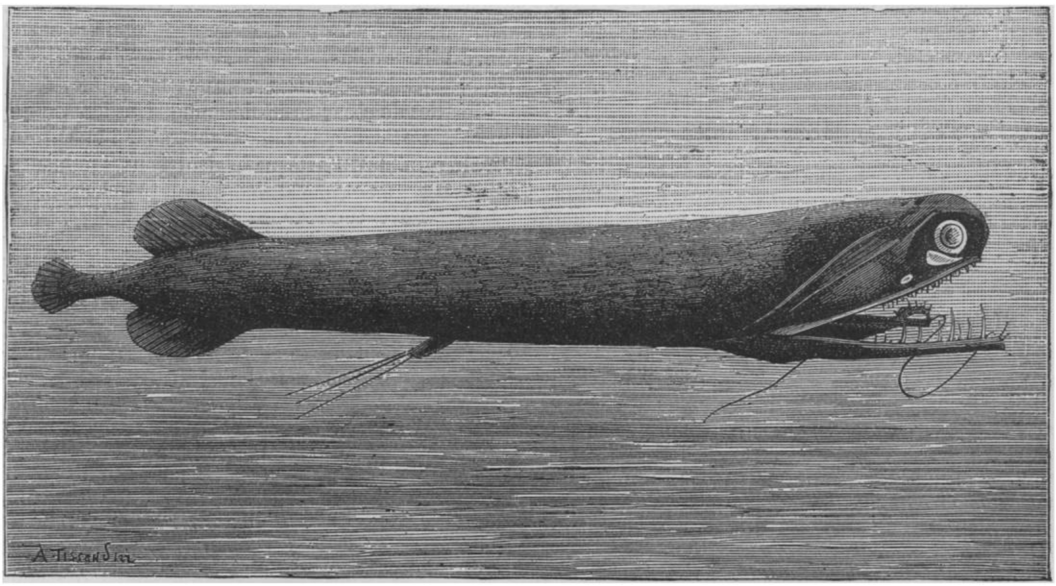


FIG. 4.—MALACOSTEUS NIGER.

Fishes at a great depth seem to move very little. They evidently live buried in the ooze, for one invariably notices bits of lime on their bodies. Often several fin-rays, instead of performing their usual duty, become organs of touch. One of the most remarkable examples of this is shown by a fish caught on the coast of Africa, the Melanocetus Johnsoni (see figure, p. 621). In this animal, which was known only by a single specimen found dead on the surface near Madeira, the first ray of the dorsal fin was developed, and formed a forward projecting true organ of touch, serving the same purpose as that of the goose-fish. In the latter fish there also exists a tentacle at the extremity of the first ray of the dorsal fin. The goose-fish lives in the sand, or ooze, where, by means of its fins, it makes a cavity in which it entombs itself, thrusting out only the upper part of its body.

One of the most interesting questions concerning the distribution of fish relates to the maximum depth at which these animals are met. On the Talisman, the fish caught at the greatest depth was Bythites crassus: it was brought up from a depth of 4,255 metres. The Challenger obtained a fish, Bathyophis ferox, at 5,019 metres.

[Mr. T. H. Bean, curator of fishes in the U. S. national museum, has furnished the following notes on the fishes obtained at the greatest depth by the Albatross, in a letter addressed to Professor Baird, and kindly placed by him at our disposal.— ED.]

The greatest depth explored by the Albatross was 2,949 fathoms (5,394 metres), which was found Oct. 2, 1883, in north latitude 37° 12′ 20″, and west longitude 69° 39′. Five species of fishes, representing

as many distinct families, were obtained in this haul. They are the following: Cyclothone lusca Goode and Bean, Scopelus Mülleri Gmel., ? Aleposomus Copei Gill, an undescribed alepocephalid with scaleless body and head, Mancalias uranoscopus Murray, and Plectropomus crassiceps Goode and Bean MS.

The species obtained at the greatest depth by the Challenger was Gonostoma microdon Günther, which was obtained by the trawl from 2,900 fathoms (5,304 metres), in north latitude 35° 22′, and east longitude 169° 53′.

There may be reason to doubt, with Dr. Günther, the pertinence of Gonostoma microdon to this extreme depth; and the same may be said of our very closely related Cyclothone lusca (a species which is at least congeneric with G. microdon), especially as we have it from depths varying between 552 and 5,394 metres; and it is abundant and widely distributed in the lesser depths. Scopelus Mülleri, also, has been obtained in 556 metres. As for ? Aleposomus and Mancalias (and perhaps, also, Plectropomus), there can be no doubt that they are true deep-sea fishes; and we may expect to find them frequently at the great depth of 5,400 metres. Mancalias uranoscopus Murray was taken at a depth of 4,390 metres by the Challenger, in the Atlantic, between Canary and Cape Verde Islands. The Albatross specimen of this species is the type of Dr. Gill's supposed new blind ceratiid genus, Typhlopsaras.

## *JOURNEY OF LESSAR TO SERAKS.*

THE military railway from Michel Bay, on the Caspian, to Kisil Arvat, was finished in September, 1882. It was afterward decided to make a preliminary survey, having in view the extension of this road to Seraks. The expedition comprised twenty Cossacks, ten sappers, two surveyors, two interpreters, and a guide, who set out from Askabad, a newly established station. In October they reached Annan, after crossing a flat country broken here and there by sandy hills some two thousand feet in height. Annan contains an immense mosque in a half-ruined condition, but with its principal façade intact, and of remarkable elegance. It is the finest of the few monuments of art in the Tekke country. The people live mostly in khibitkas: the site of the town is surrounded with ruined fortifications. Thence the route passed between the dunes twenty versts, to Gwiwars, which has three series of dilapidated fortifications inhabited by a few Kirgis and Tekkes. Several caravans of Tekkes were met with on their way from Merv to Akhala. Having taken refuge in the Merv oasis during the war, they were now expelled by the Mervli, who feared famine from the presence of too many people. The distance from Gwiwars to Baba Durmaz was found to be thirty-six versts, over an undulating country. Water is conveyed to Durmaz by a canal, and, though a little salt, is used by men and beasts without inconvenience. The chiefs of Khorassan, enraged by the conquest of Akhala, and discontented at the reign of order established by Russia on the steppes, are in general unfriendly. The population, however, are well satisfied, and enjoy a peace which they have never known. They are no longer raided by the Mervli, and many men formerly enslaved at Khiva or Akhala have returned to their villages in freedom due to the Russian conquest. From Durmaz to Liutfabad the forests have been cut away, and the soil is riddled so by the burrows of porcupines, that men and horses stumble at every step. Here and there are hillocks surmounted by ruins of towers or ramparts. Very lately each village or farm of this country possessed a round tower, with a single entrance closed by an enormous stone, to which the inhabitants retired at a moment's notice of the approach of one of the robber-bands who infested the region. The robbers did not attack the tower, but stole or destroyed every thing outside of it. At present a watch is rarely kept, and the towers are falling into decay. Liutfabad has a bazaar, reputed the best in all that country, where, however, the only goods were sugar, dry raisins, rice, nuts, bad tea, and henna. The inhabitants held the kindest relations with the Russian explorers. Thence to Kaakha the country for thirty versts is fertile, well watered, with a numerous population; but the streams are destitute of bridges. Woods were observed toward the mountains north of the route.

Near Kaakha the uniformity of the plain is broken by villages, fortifications, and numerous tumuli generally on the banks of streams. These last were said by Vambéry to be erected by the Tekkes over the graves of their chiefs; but the people deny this, and there is little doubt that they are prehistoric. They are circular or elliptical, and reach fifteen or twenty metres in height. Along the route the people worked in the fields with horses or camels, and did not avoid the Russians, but met them on friendly terms. The approach of the party constantly started up pheasants, partridges, and other game from the fields. The Tekke *cuisine*, observed by the explorers, did not comprise the revolting dishes reported by Vambéry, but included pilau, game, camel's milk, melons, and pastry. The people eat with their fingers, but have wooden spoons. On all the steppes many termite-hills were visible, hemispherical, a foot and a half high, and two feet in diameter. These insects are amber-colored, and half an inch long: they form a covered way to any object which they desire to consume, especially wood or cloth. Though destructive to wooden buildings along the line, they have not injured the sleepers of the railway, which is ascribed to the jarring motion produced by the passage of trains, which is supposed to destroy their mud-tunnels, outside of which they will not work.

Seraks is a rather large fortress occupied by a battalion of Persian infantry. The outer line of works is extended to include farms and vineyards. The environs are habitually pillaged by Tekke robbers, who inspire such fear that the garrison never ventures on a *sortie*, and dares not attempt to succor a caravan attacked within a mile or two of the ramparts; and at night the patrol always carry torches. The fortress is armed with six old useless cannon. The River

Tejent passes near Seraks, but is generally dry: its bed is about half a mile wide. The water from the melting snows and heavy rains is retained in large reservoirs closed by sluices, and distributed by canals for irrigation. Wells reach water at a depth of twenty feet.

The levelling carried on by the party has demonstrated, that, in leaving the Caspian Sea, there is not a general rise of the surface. At the wells of Aydine, several points are notably lower than the surface of the Caspian; and the whole region between the latter and the wells is a dried up arm of the sea. The aspect of the observations leads one to believe that they will show, when worked up, that there are many points in the sandy deserts between the Tekke oasis and Khiva which are lower than the Caspian; and it is already certain that the alleged former junction of the Tejent and Murial Rivers with the Oxus was an impossibility, and that, though nearer to each other, they emptied directly into the Caspian. Further work will be necessary to show the exact origin of the depressions met with in different parts of the steppes, and which have been taken for beds of ancient water-courses.

The expedition terminated its work at Seraks, and returned to Askabad by a different route.

## *PALMS.*

SOME interesting details respecting these princes of the vegetable kingdom, as Linnaeus called them, are to be found in Sir Joseph Hooker's last report on the progress and condition of the Royal gardens at Kew. The extent to which they have recently been brought into cultivation is noteworthy.

Miller, in his Gardener's dictionary, edition of 1731, knew of seven species; but only two were generally known in conservatories, — the dwarf fan-palm of the south of Europe, and the date. Aiton's Hortus Kewensis, in the second edition (1813), enumerates only 24 species. The Loddiges, great cultivators of palms, who possessed in their day much the largest collection known, enumerate 210 species in their nursery catalogue of the year 1825. In the Herrenhausen conservatories, Hannover, Wendland had assembled 287 species in 1835, and 445 in 1882. This is the largest collection in the world; but the noblest must be that of the Botanical gardens of Buitenzorg, Java, which, in 1860, boasted of 273 species, 'all standing naked in the open air.'

It is only when the literature of the order is brought together systematically, that we appreciate the extent and the variety of palms. In the new Genera plantarum, Sir Joseph Hooker characterizes 132 genera of true palms, and indicates about 1,100 species.

Our readers may like to know what palms are indigenous to the United States, and what names they now bear. Without counting one or two tropical species which grow in southern Florida, and which are outlying Cuban and Bahaman species, we have two true palmettos, Sabal palmetto, and S. Adansoni; the blue palmetto, Rhapidophyllum hystrix of Wendland; the saw palmetto, Serenoa serrulata of Hooker. This is the old Sabal serrulata, upon which Hooker has recently founded a new genus, dedicating it to our associate, Sereno Watson (*Palmam qui meruit ferat*), there being already a Watsonia in honor of an earlier botanist of this name. Finally we have, just beyond our national borders, namely, on the islands off Lower California, a palm of a peculiar genus, instituted by Mr. Sereno Watson, the Erythea edulis; and in southern California the elegant Washingtonia bilifera, with which Wendland has complimented our country by naming this palm in honor of its first president. The only other president so distinguished is Jefferson. Jeffersonia diphylla is one of our choicest spring flowers.

## *THE DEARBORN OBSERVATORY.*

THE report of Prof. G. W. Hough, the director of the Dearborn observatory, to the board of directors of the Chicago astronomical society, exhibits an encouraging state of activity in that establishment. The eighteen-inch equatorial and the Repsold meridian circle have been kept in excellent order and in constant use; though it does not appear, from the report, that this latter instrument has been employed in any service where a smaller and less adequately equipped instrument would not equally have sufficed. The objects specially studied with the great telescope were the great comet of 1882, difficult double stars, and the planet Jupiter, in addition to which a few miscellaneous observations were made. The comet-observations are of interest as throwing some light on the question of the breaking-up of this body into three separate and distinct fragments, and the testimony of so powerful a glass is of high importance. Professor Hough's observations, from Oct. 5, 1882, to March 6, 1883, are all consistent with regard to the apparent separation of these three centres of condensation; but they were all the time connected by matter of less density, so that no complete separation took place between the parts of the head.

Sixty-six new double stars were discovered during the year, most of which are difficult objects, and can be measured only when the seeing is good. Professor Hough estimates that not more than one observing night in three is suitable for such observations. In the search for D'Arrest's comet, six new nebulae were detected, three of which were found by Mr. Burnham. The companion to Sirius was measured on a goodly number of nights by both these observers. Professor Hough expects this object to be, in a few years, entirely beyond the reach of all telescopes except the largest ones, as the distance between the components (now nine seconds of arc) is diminishing about three-tenths of a second annually.

The great red spot on the planet Jupiter, first noticed in 1878, and which has been, until the past year, of a reddish-brick color, has gradually grown paler, until, at the present time, it is barely visible. Professor Hough ventures the opinion that it cannot be seen much longer in any telescope. Its stability has been remarkable, not having changed very ma-

terially in length, breadth, outline, or latitude, during four years' time. A slow retrograde drift in longitude has, however, taken place quite uniformly. The summary of mean results of Professor Hough's micrometric measures of the spot is as follows: —

| | 1879. | 1880. | 1881. | 1882. |
|---|---|---|---|---|
| Length . . . . . | 12.25″ | 11.55″ | 11.30″ | 11.83″ |
| Breadth . . . . . | 3.46 | 3.54 | 3.66 | 3.65 |
| Latitude . . . . . | −6.95 | −7.14 | −7.40 | −7.52 |

While the spot has remained thus nearly stationary in latitude, the south edge of the great equatorial belt has gradually drifted south during the late opposition, until it is nearly co-incident with the middle of the spot. But, what is remarkable, the two do not blend together, but are entirely distinct and separate, seeming thus to indicate that they are composed of matter having repellent properties, similar to two clouds charged with the same kind of electricity.

In the years 1664, 1665, 1666, a great spot, with a diameter of some eight thousand miles, or about one-tenth that of Jupiter, was observed by Hook and Cassini, and situate in latitude 6″ south of the planet's equator. The spot re-appeared and vanished eight times between 1665 and 1708, was invisible from this latter year until 1713, and the longest period of its continuous visibility was three years, and of its disappearing, five. Professor Hough suggests the possible identity of that great spot with the present one, taking much the same ground with Russell of Sydney, — that it is a portion of the solid body of the planet, or *Jupiter firmus*, so to say, and is ofttimes rendered invisible by a covering of clouds. Professor Hough does well to call attention to the incorrect statement, so universally made in the astronomical text-books, that new belts are formed on the disk of the planet in the course of a few hours' time. The appearance of the disk changes from hour to hour, owing to the rapid axial rotation of the planet; and, as we pass from the equator to the poles, the apparent transit of an object across the disk becomes slower and slower. Observers, even at the present time, not always realizing that they are looking at a globe, and not at a plane surface, make statements regarding rapid changes in size or shape of objects on the planet's disk that are not legitimate deductions from the actual observations.

Regarding other configurations of the disk of Jupiter, Professor Hough notes the drifting south of the great equatorial belt nearly two seconds of arc during the late opposition. Small oval white spots were observed to be quite numerous. They were difficult to observe, and their identification is somewhat uncertain; but they appear to have a general retrograde drift at the rate of seventy miles per hour. Great numbers of minute white spots and markings near the equatorial regions were also observed, the discussion of which is reserved; but it is a curious fact that these spots should drift for years with the enormous velocity of two hundred and sixty miles per hour, if they are nothing more than clouds in the planets' atmosphere. The series of micrometric measurements on all these belts and spots appears to have been sufficiently elaborate, and the results derivable from a complete discussion of them will surely possess much of interest. Four sketches accompany the report, which show the salient features of the disk merely, no attempt having been made to represent the minute detail of the equatorial markings.

About the average success is reported in the contact-observations of the transit of Venus, of December, 1882. Mr. Burnham assisted in taking a number of dry-plate photographs of the planet on the sun, which present very sharp outlines of the disks of the sun and Venus. The method of insuring a minimum exposure, ordinarily in use by photographers, was employed; the equivalent exposure for any part of the sun's disk being as short as one sixteen-hundredth part of a second. Professor Hough regards these experiments as showing conclusively that astronomical photography will be most successful when the time of exposure becomes a minimum.

DAVID P. TODD.

## *A NEW MOTOR.*

THE pneumatic tramway engine company of New York has recently issued a prospectus, in which it presents the claims of compressed air as a motor for short lines, with statements of the results of experiments with a motor built for them by the Baldwin locomotive-works. The engine was used, experimentally, on the Second-Avenue elevated railroad in New-York City, with what would seem to have been very satisfactory results.

The locomotive has four driving-wheels, two working cylinders of twelve inches and a half diameter and eighteen inches stroke of piston, with running-gear like that of the standard steam-locomotive of small power. In place of the boiler there are four air-reservoirs, each three feet in diameter, of Otis steel, half an inch thick, having a tenacity of seventy-five thousand pounds per square inch of section, and made up with the spiral seam introduced by Root. These reservoirs are tested to eight hundred pounds per square inch, and are filled with air at six hundred pounds. A small steam-boiler inside the cab is used as an air-heater, and raises the temperature of the air leaving the reservoirs, and on its way to the cylinders, to about 240° F. A reducing-valve causes the pressure to fall, at the cylinders, to a hundred pounds per square inch, the working-pressure for the engine. The cylinders are lubricated in part by the water taken up in the heater, where the air bubbles up through the confined liquid, and in part by oil, introduced for that purpose. The main valve is worked in full gear, and expansion is obtained by the use of an independent 'cut-off valve' on its back.

The 'braking system' is as novel as it is ingenious and effective. The engines are reversed, as in the method of Le Chatellier; and they thus become pumps, taking in air, which is forced into the main reservoirs to replace that expended in propulsion.

The system is made still more effective by taking this air, not from the exhaust-pipe, but from the air-brake cylinders beneath the cars, and thus operating the continuous brakes on each car as well as the same work is done by the common Westinghouse system.

The experimental engine has drawn trains of three and four loaded cars from Harlem to the Battery, New-York City, a distance of nine miles, in two minutes and a half less than schedule time, — forty minutes, — making all stops, and on three-fourths of a single charge of air. The engine will handle well, alone, with a pressure of twenty-five pounds.

It is impracticable to cover long distances without refilling the reservoirs, and it is not proposed to attempt doing so. The reservoirs are to be filled at every ten-miles run, or every forty or fifty minutes; and filling-stations are to be provided at proper intervals along the line of the road. The reservoirs are so well made, that the engine stands all night, under a pressure of one hundred pounds, without appreciable loss of pressure.

The obvious and unquestionable advantages of this method of transportation are: safety from the dangers of explosion, which, aside from simple pressure, are unavoidable with steam and water; perfect cleanliness, not only on the engine, but along the line and on the train, in consequence of the avoidance of dust and smoke, and sparks from the engine; freedom from gas from the locomotive; less noise than with the steam-engine; freedom from the annoyances from dripping hot water, soiling the clothing, and half scalding the unfortunate pedestrian beneath; permanence of the reservoirs, which cannot be burned out, as can the steam-boiler, and which cannot be injured by the corrosion, due to leakage of water and steam, which is so serious a cause of injury to the steam-boiler. The engineer appreciates the latter points particularly, as well as the comfort of having no fire or fireman to look after and to distract his attention from his duties at the throttle, and ahead of the train. He is even saved the responsibility and taxation of 'looking out for the water' in the boiler, which is no small matter on the steam-locomotive.

Comparing the commercial sides for the two motors, the air-locomotive will undoubtedly be found to cost much less for repairs, to lose vastly less time in the shops, and to demand very much less of the time of the engineer and of the master mechanic, when off the road. Whether the cost of running will be so small as to permit the adoption of the system on our elevated railroads, and other railroads to which it may be as well adapted, cannot, as a matter of course, be certainly known until the experiment shall have been tried under all the best conditions for its operation. This is, in fact, the question to be determined. The experiment on the New-York lines is evidently very encouraging; and it is to be hoped that the very favorable estimates offered by its promoters may be confirmed by long trial, and the successful introduction of the motor. So far as we are aware, the compressed-air locomotive has hitherto been used only where, as in the longer lines of tunnels, there existed peculiar reasons for its introduction. The experiment is a perfectly legitimate one, and the new company are entitled to every favor that can be properly accorded those who attempt in any way the amelioration of the annoyances and the dangers of railway travel. R. H. THURSTON.

## DANIELL'S PRINCIPLES OF PHYSICS.

*A text-book of the principles of physics.* By A. DANIELL. London, *Macmillan*, 1884. 20+653 p. 8°.

MANY of those who have been engaged in teaching physics to undergraduates during the last ten years have felt the want of a text-book more in accord with the present condition of the science than the majority of those accessible to the English-reading student. It is doubtless a fact, and a curious one, that those most generally in use in this country are, or perhaps it is better to say were, originally translations from the French; and this in spite of the generally admitted leadership of English-speaking people in this department of science.

Although, perhaps, the best attainable up to the present time, these English translations of French text-books have certainly fallen short of perfect adaptability to the work, and more and more so as the years passed by. It is true that an attempt has been made by the editors and publishers to keep pace with the rapid growth of the science, but this attempt has met with but doubtful success.

Any system or design or scheme which may have existed in some of these books in the beginning has been pretty effectually destroyed by the numerous additions which have been made from time to time, in the placing of many of which the convenience of the printer seems to have been oftener consulted than any thing else.

Although one may find a brief account of the very latest discovery or invention up to the time of going to press, he is likely to find it in a most unexpected place; and, although here and there will be found detailed fragments of modern theory, they are often so purely fragmentary as to be quite unintelligible to the student. In fact, the book comes to resemble a conglomerate in its structure; and the student, in attempting to 'go through it,' meets with sudden and remarkable changes in hardness and density. The fact is, the change which has been going on in the science of physics during the last fifteen or twenty years does not consist alone in the series of brilliant discoveries and inventions which have brought it glory and renown: along with these there

have been almost equally important revolutions in its methods and principles. It is less a collection of facts and experiments than it once was. Indeed, the accumulation of these within the past decade has been so rapid, and the collection is now so vast, as to preclude the idea of even an attempt to enumerate them in a text-book. Fortunately the accumulation of facts has been accompanied by classification and orderly arrangement. Theory and practice have been close companions, each occasionally taking the lead. Not many years ago it was possible, in a text-book of moderate dimensions, to state nearly all of the principal facts relating to certain departments of physics, which are to-day represented by special treatises, numbered by the hundred. The text-book for the undergraduate can no longer attempt to deal with these matters in detail. It must confine itself to a consideration of the established *principles* of the science, with such, and only such, experimental illustrations as are necessary to enable the student to comprehend these principles. Experiments must be typical rather than special in form, and of such a character that the phenomenon to be exhibited is the prominent feature, rather than the particular piece of apparatus with which it is shown.

In the preparation of this book, its author has taken a new departure, and largely in the direction indicated. In glancing through its pages, one is equally surprised, both by the presence of many things which he has not before seen in text-books of a similar grade, and by the absence of many other things to the sight of which he has long been accustomed. Of the latter, the most noticeable, at first, are the fine pictures, the absence of which is a conspicuous feature of the book: indeed, the character of the work is revealed more promptly through this feature than any other. Cuts and drawings are introduced whenever, in the opinion of the author, they are necessary to elucidate the text; but they are generally of the simplest character, and such as can readily be reproduced upon the blackboard, or added to, if thought desirable, by one possessing little skill. In describing an experiment, only the absolute essentials are shown; the details of construction, and special forms of apparatus, being left to the imagination of the student, or the descriptive powers of the teacher. Perhaps the economy exercised in this direction has been a little too rigorous; but the plan possesses great advantages, both direct and indirect. One is spared the elaborate descriptions of apparatus which occupy so many pages of other text-books. It must be admitted that this is, on the whole, a considerable gain. It is often difficult to understand a complicated instrument from a description and a cut; and often the more accurate the latter, the greater the difficulty, as much attention will be given to the really non-essential parts. Students have a perverse way of being interested in the architecture of an instrument, and often receive a more lasting impression from its 'elevation' than from its 'ground plan.' It is not an uncommon experience to find that a man will study an instrument from cut and description in the text-book, and fail to recognize the same thing under a somewhat different form, when it is placed on the table before him. It would be interesting to know how many undergraduate students who have studied electricity are able to distinguish the soul of a galvanometer from its body so completely as to be able to recognize it in all of the numerous forms in which it materializes.

Again: in many instances the instrument so carefully figured and described in the text-book has become obsolete, which can hardly be said of the principle involved.

The omission of this illustrative and descriptive part of the text-book is to be commended because it leaves room, — it leaves room for the introduction of much matter, which is certainly more than the equivalent of that which is omitted.

Considerable gain in space accrues from another noticeable feature of the book, in which it differs materially from those more generally in use.

It is not a book of reference. The reader will not fail to observe the entire absence of tables, and will look in vain for collections of physical constants, or of numerical data, or of the various and varying results of different experiments in quantitative investigations. The history and personal aspect of scientific discovery will be missed by many, and this omission was evidently reluctantly decided upon by the author.

Strip some of our well-known text-books of all these, and they will shrink very considerably in their dimensions. There may be difference of opinion concerning the desirableness of these omissions. Our author has unquestionably assumed, that, wherever his book is used, there will be a good collection of physical apparatus, which may be accessible to the student for examination when desirable; and an enthusiastic and competent instructor, who knows the history of his subject, and can arouse the interest and enthusiasm of his class by suitable references to eventful periods of discovery

and to the personal characters of discoverers. His text-book provides the pupil with the meat of the subject: the side-dishes, dessert, etc., must be furnished by the teacher.

The book is an octavo volume of about six hundred pages, — not larger than several well-known treatises in general use. Only an elementary mathematical training is assumed; so elementary, in fact, that the author has thought it desirable to define the well-known constant $\pi$, which he does in a note. Let no one be deceived by this, however: the student will discover, as he progresses, that he must know his elementary mathematics well, and that he must possess facility and readiness in the use of symbols.

In the introduction, some of the fundamental principles on which the science is based are discussed. One or two terms concerning which there has been more or less dispute are handled a little delicately in the beginning. An instance of this is the use of the word 'force.' The author is a little shy about defining it at first. His confidence grows, however, as the work progresses; and he once or twice hints at, but never quite reaches, the neat statement of Clerk Maxwell, that force is 'one of the aspects of a stress.'

A chapter is devoted to the processes of measuring space, time, and mass, in which the rather discouraging statement is made, that "good linear measurement, in whatever way effected, ought to present an error less than one-millionth of the whole." There is a well-written chapter on work and energy, including a brief discussion of the indicator diagram. This is followed by the subject of kinematics, covering more than a hundred pages.

The treatment of this subject is somewhat novel for a book of this class, including, as it does, a tolerably complete discussion of simple harmonic motions, their composition and resolution; a statement of Fourier's theorem; a discussion of waves and wave-motions; the propagation of waves, their reflection, refraction, interference, and diffraction; the vibrations of chords, membranes, etc. In the statement of Ptolemy's law for reflection, and Fermat's for refraction, often known as the principles of least distance and least time, the author has failed to note the very important exceptions to both, or to give the limitations to which they are subject.

There follows the subject of kinetics, in which some general propositions in reference to forces are derived from those already established in the study of motion. Moment of inertia, radius of gyration, and energy of a rotating body, are more thoroughly treated than is customary in such a treatise.

There is a very satisfactory chapter on attraction and potential. Potential of a point in space, equipotential surfaces, lines and tubes of force, etc., are discussed in a manner so clear and intelligible as to enable the student to be somewhat master of the situation when he comes to the practical application of these conceptions. The chapter on gravitation and the pendulum is satisfactory; but, in the last proposition, the author has made the not uncommon mistake of failing to correctly state the conditions of the reversible pendulum. It is a little curious that it is not oftener observed that a symmetrical bar will oscillate about *any* two points equally distant from the centre of gravity in the same time. Students are likely to be considerably puzzled when they attempt to determine in this way the length of a single pendulum, and discover, that, the shorter the pendulum, the longer the period of vibration.

In many text-books the study of matter and its properties forms the subject of the opening chapter; with some propriety, perhaps, as matter is assumed to be the solid foundation upon which the science of physics rests. In this volume, however, it is not discussed until nearly two hundred pages have been passed over. One of the peculiar features of the treatment of the subject by our author is the admission of the ether as a form of matter; and the reasons for so doing are ably presented. Its properties as matter are explained as far as known or surmised, and the vortex atom is not forgotten. The chapter includes a discussion of the molecular constitution of matter, a brief consideration of surface-tension and superficial viscosity, with their application to capillary phenomena, and a brief study of viscosity of solids, liquids, and gases.

The middle of the book is passed before the study of heat is begun. Heat is considered as including two totally distinct forms of energy; and the treatment of what is known as radiant heat is deferred until a later period. Under the head of heat proper will be found some discussion of the principles of thermodynamics, including a treatment of Carnot's cycle. It occupies forty pages, and might have been improved by a more complete presentation of the subject of conduction. Sound is considered through fifty pages, in which musical intervals and scales, the vibration of strings, and the propagation through solids, liquids, and gases, receive rather more attention than is usual.

Under the general head of 'ether-waves,' the unity of the so-called heat, light, and actinic rays is explained. The theory of exchanges, and Stokes's law, are considered. The treatment of color is extremely satisfactory. The origin and propagation of ether-waves, reflection, refraction, and polarization, together with the postulates of Fresnel, Neumann, and MacCullagh, occupy considerable space. All of this precedes what is generally known as geometrical optics, which is not elaborately discussed. In double refraction the Huyghenian construction is given, and the study of optical instruments is remarkable for its brevity.

Electricity and magnetism are provisionally defined as properties or conditions of matter, the matter referred to being that extraordinary form known as the ether. Just enough in the way of experiment is given to enable the student to understand the development of the principles of the subject, which are established under the assumption that he has mastered the chapter on attraction, potential, etc., already referred to. Some of the notable features of this part of the work are more than ordinarily intelligible discussions of thermo-electricity, Peltier's and Thomson's 'effects,' the presentation of Maxwell's theory, with his electromagnetic theory of light, and brief mention of Rowland's, Kerr's, and Hall's experiments. There is also a comparison of units in the electrostatic and electromagnetic systems, and a discussion of the meaning and value of the constant $v$. The arrangement of topics in electricity and magnetism may be criticised, in that it would seem desirable to have introduced the subject of magnetism and magnetic potential at an earlier stage, thus making possible an earlier exposition of the origin of the electromagnetic units of measure.

In connection with the matter of units, it is worth while to remark, that throughout the work the author has felt constrained, possibly out of respect for an unwholesome English prejudice, to make frequent use of the foot, inch, pound, ounce, grain, etc. It is, perhaps, hardly fair to expect an English author to adhere strictly to the use of the metric system; but in the present instance the confusion of the units is a blemish all the more noticeable by reason of the otherwise simple and elegant methods of treatment. Clumsiness of statement and solution is frequently the unavoidable result. No evidence of this is needed; but it may not be amiss to quote from so conservative a source as Thomson and Tait (Nat. phil., art. 408), who, although selecting the foot as being 'for British measurement generally the most convenient,' remark, that "the British measurements of area and volume are infinitely inconvenient, and wasteful of brain-energy and of plodding labor. Their contrast with the simple, uniform metrical system of France, Germany, and Italy, is but little creditable to English intelligence."

Not the least remarkable feature of the book is, that its author is a lecturer in a medical school, and it "was primarily designed as a contribution to medical education."

Altogether the book must be regarded as one greatly in advance of those of a similar grade generally in use. It is not intended as a substitute for a laboratory and laboratory practice, for no book can be this; but it is admirably adapted for a preparation to a laboratory course, in that it furnishes the student with such "a store of general principles, that, when he comes to enter a physical laboratory, he may then find around him, in the concrete form, a collection of pieces of apparatus the construction and the action of which he is able, by the application of principles already familiar to him, promptly and intelligently to comprehend."

The belief that such a text-book will be gladly welcomed by many teachers of physics in this country may justify the somewhat extended reference to its character and contents, given above.

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## *PROPAGATION OF TUBERCULOSIS.*

*The influence of heredity and contagion on the propagation of tuberculosis, and the prevention of injurious effects from consumption of the flesh and milk of tuberculous animals.* By A. LYDTIN, Carlsruhe, veterinary adviser to the Baden government; G. FLEMING, LL.D., F.R.C.V.S., principal veterinary surgeon to the British army; and VAN HERTSEN, veterinary surgeon, and chief inspector of the Brussels abattoir. New York, *Jenkins*, [1884]. 175 p. 8°.

THIS volume is a translation, by one of the committee upon its preparation, of a report prepared for discussion at the International veterinary congress, held at Brussels in September, 1883. The question of the etiology of tuberculosis is one of the most important of modern medicine, and occupies the attention of a large part of the profession to-day. Its importance is not confined to the human race, in so far as it attacks mankind; but, be-

ing so wide-spread among domestic animals, it necessarily affects humanity in this direction also.

The report before us is a valuable summary of the condition of scientific knowledge at the present day, upon this question, in its relationship to domestic animals, and, through them, to mankind. It begins with an account of the nomenclature of the disease from the earliest times to the present, discusses the best means of diagnosis, the course and the anatomical appearance of the disease. In regard to the latter point, the conclusion already generally accepted by medical men is reached, that the 'criterium' of the disease must be sought in the irritant which causes it, and that this irritant is found in the bacillus of Koch. In connection with this portion of the report, there is a very good discussion of the predisposing causes of the disease (pp. 35–49), followed by a consideration of the animals (other than cattle) that are known to be subject to attack by it. The conclusion is reached, after all this, that "tuberculosis is, of all maladies affecting the domesticated animals, that which is the most wide-spread, and which, of all others, most deserves the qualification of 'panzooty.'"

The second chapter of the book is devoted to a consideration of the question, "What is the influence of heredity on the propagation of tuberculosis?" (pp. 55–68.) After the consideration and quotation of many cases and authors, a number of conclusions are reached, of which the last seems to contain the essence, — "that tuberculous parents may transmit to their progeny a predisposition to tuberculosis."

The second question, "What is the influence of contagion on the propagation of tuberculosis?" receives very thorough consideration. A large number of authors — from Ruhling in 1774, to Villemin and Koch in our own day — are cited to prove the contagious nature of the disease. A summary of the reasons for the opinion that animal and human tuberculosis are one and the same is given (pp. 85–98); and this portion of the work is concluded by a short *résumé* of Koch's labors on this disease.

The discussion of the third question, "What are the preventive measures which should be had recourse to, in order to arrest the injurious effects which may result from the use of the flesh and milk of tuberculous cattle?" is opened with a review of the ancient laws against the use of diseased meat, together with some account of the various attempts made in more recent times to regulate this traffic.

The two plans for the regulation of the sale of diseased meats are thus summarized: "*a*, All preventive measures may be reduced to the simple advice to cook the flesh well before eating it; and, *b*, Flesh of tuberculous animals should be confiscated, either in every case, or in certain circumstances." The first method of procedure is unsafe; because, in the first place, it would probably not be thoroughly done, and, in the second place, a recommendation alone would not influence in the least those who are in the habit of eating raw or almost raw meat (a common practice in Central and North Germany). The objections to, and the difficulties in the way of, the adoption of the second method, that of regulation, are mentioned, and discussed in an exhaustive manner; the effect of laws of partial or complete confiscation of affected animals is shown; the action of 'warranty' laws upon the morals of the butcher and owner, and the general effect of any attempt at regulation upon the cupidity of owners and of all concerned, are well illustrated.

A number of recommendations to the congress are made for adoption, too long for quotation, but seemingly based upon a firm ground-work of knowledge and experience. The report was brought on for discussion at so late a period in the session that not much was done in this direction. The sense of the meeting, however, seemed to be, that some law should be framed, restricting at least the sale of the meat of animals affected with tuberculosis.

The report, as a whole, contributes nothing, from an experimental point of view, to our knowledge of this disease, but, as before stated, is a very complete *résumé* of the question as it stands to-day in its hygienic and pecuniary relations. It will be of interest and importance to all veterinarians, as a summary of the knowledge thus far obtained, and as an index to the original sources from which this knowledge may be drawn. To scientific men actually engaged in the working-out of the problem of the etiology of tuberculosis, it can be of interest only as presenting the case from the veterinarian's stand-point.

The book is well gotten up, and clearly printed, but few errors having escaped the eye of the proof-reader. For ourselves, we should prefer *cyst* to *kyst*. The addition of an index would have made the book more serviceable to the general reader, and for purposes of reference.

# INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

## GOVERNMENT ORGANIZATIONS.

### U. S. geological survey.

*Mineral statistics of the United States.* — Mr. Albert Williams, jun., is arranging for the issue of a second volume on the mining industries and mineral resources of the United States, and is now engaged in the preliminary work necessary to facilitate its preparation. This report will cover statistically the calendar years of 1883 and 1884; preserving, however, the record for former years, already published in his first report. The general form and scope of the work will be similar to that previously followed. Repetition of text matter will be avoided, and the chief aim will be to treat in greater detail such topics as could not well be enlarged upon in the first report without extending it beyond the proper limits.

The second volume, while complete in itself from a statistical point of view, will complement the first in the matter of description of localities, metallurgical processes, etc. A change which will add to the interest of the work will be the introduction of a series of graphic statistical charts, showing at a glance the progress in the several industries. A fair start has already been made, and the work will be pushed energetically with a view to secure the promptness in publication which is so necessary in reports of this class. The value of such statistics to the industries whose progress they record is the quickness with which they are given to the public. There is a somewhat prevalent idea that such work cannot be published within a reasonable time after the expiration of the time to which it refers. This is refuted by Mr. Williams's first report, which was issued early in the fall of 1883; and the results of the work, in a condensed form, were given to the public within a few weeks after the manuscript was given to the printer, which was on the 30th of June, to which date the production statistics were carried.

*Glacial striae.* — Prof. T. C. Chamberlin is collecting and compiling all observations on glacial striation within the limits of the United States. The results of his work will be embodied in a bulletin to be published by the survey. He would be glad to incorporate any unpublished notes which observers may be kind enough to communicate. As full details as practicable are desired, relating to the character of the striations, locality, kind of rock, inclination of striated surface, altitude, and other topographical relations, etc. Professor Chamberlin would also esteem it a favor to have his attention directed to observations recorded in unusual publications, or in those not readily accessible, or for any other reasons liable to be overlooked.

*Topographic notes.* — The work of compiling topographic material for the map of the District of Columbia and adjoining territory has been completed; and the party under Mr. S. H. Bodfish's supervision was, during March and April, engaged in field-work for the purpose of obtaining data, with the object of finishing the survey of the area left untouched by the coast and geodetic survey. —— Field-work for the completion of the map of the Denver basin will soon be undertaken. Mr. Anton Karl, who has charge of the topographic work in the Rocky Mountain district, has left the Washington office, and is on his way to Denver to begin this work, which was temporarily suspended last summer. He expects to finish it in about six weeks. All that remains to be done is to carry the triangulation over the area, and to complete the filling-in of the contours. The map will include about a thousand square miles, on a scale of one mile to one inch. —— In the division of the Pacific, work during March was much interfered with by rainy weather. Mr. Hoffmann, after completing his map of the New Idria district, proceeded to Sulphur Bank, where he was making good progress, correcting and adding to his former work there. —— Office-work is progressing satisfactorily. Some of the maps are fast approaching completion, and preparations will soon be made for putting the various parties in the field for the coming season.

# RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

### Torrey botanical club, New York.

*May 13.* — Mr. Bicknell read a paper upon Carex Pennsylvanica and Carex varia, referring particularly to the difference of habit of the subterranean parts of the plants. C. Pennsylvanica throws out runners early in the year, which soon root, and become underground stems. These extend in all directions from the parent plant, each fostering a succession of shoots, some of which themselves become centres of a secondary series of runners. I have unearthed these runners, bearing, at intervals of a few inches, four or more generations of living shoots, together with the remains of several older generations. It thus appears that the new shoots do not always become established as separate plants, but that often a series of tufts remain permanently attached by underground connection for many years. The *separate* tufts do not appear to live more than about two years. Where this sedge grows in abundance its runners may be found crossing and re-crossing beneath the surface of the ground; and careful excavation will show that many apparently distinct plantlets belong to the same system of underground stem. The runners are at first clothed with closely imbricated scales, arising from nodes all along the stem. These ultimately decay, and become frayed into a coarse fringe, which remains apressed to the stem in whorls from every node. In C. varia the habit of growth is entirely different. This species shows no

disposition to spread laterally, but grows in close tufts. These spring from a dense, knotty mass of small, closely aggregated root-stocks, which bear a profusion of long, fibrous roots. Year after year these rooty masses produce an abundance of new shoots, which rise from the surface amid the old. Each ultimate root-stock becomes the site for a closely clustered colony of compound shoots; and these secondary tufts, compacted into a single mass, make up the plant. A slight lateral prolongation of a shoot is sometimes necessitated by an obstruction in the most direct way to the surface, but this is the nearest approach to subterranean spreading. In no other of our species of Carex, of the section Montanae, do we find the counterpart of the underground stems of C. Pennsylvanica. The closest approach towards them is shown by C. umbellata. From its dense underground tufts, this plant sometimes produces short underground stems; these are, however, more like suckers, and do not stray far from the parent plant, merely assisting to increase its dimensions. C. pubescens is of less tufted habit than either of the other species of this section; the shoots being irregularly produced by a progressive underground stem, or root-stock, which, however, bears no resemblance to the underground runners of C. Pennsylvanica.

The Brookville society of natural history, Indiana.

*May 6.* — A. W. Butler described the extent of the Niagara formation in Franklin county, and gave a section showing the stratification near the town of Laurel. He described the varying thickness of the strata, the economic uses of the stone, the southwestward dip of the strata, and the quantities of chert which are found in locations on top of the best building-stone. —— D. R. Moore gave an account of some peculiar mounds in Butler county, O., and Franklin county, Ind., confining his time mostly to the 'Glidewell mound,' four miles northeast of Brookville. This mound is situated nearly three hundred feet above the east fork of the White Water River, on the point of a ridge jutting out into the river. The mound is sixty feet in diameter, and at present is twelve feet high. It is built of earth which has been brought from some other locality, as no such earth has been found within about half a mile of its location. The mound has been covered with large, flat stones, overlapping each other after the manner of shingles on the roof of a house; and these stones are now covered with vegetable mould, in some places to a depth of almost two feet.

Academy of natural sciences, Philadelphia.

*April 29.* — Mr. Joseph Willcox called attention to a fine collection of upwards of eighty specimens of fifty species of marine sponges made by him during the winter in Florida, and presented to the academy. Continuing his remarks on the geology and natural history of Florida, Mr. Willcox stated that the rocks which line the west coast extend out for many miles into the Gulf of Mexico, making the waters very shoal. The channels of the streams from the mainland continue out through these rocky shoals in the same direction, and with the same tortuous course as before reaching the shore. The limestone of the peninsula is soft, and eroded into a vast number of caverns and sink-holes. Where exposed at an elevation, the rock becomes hard and firm, in some localities resembling marble. Referring to Agassiz's suggestion that the sea-urchins of the coast which cover themselves with seaweed do so for protection, the speaker remarked that such an explanation was open to doubt, as allied forms which have the habit of covering themselves with little mounds of white shells are rendered thereby much more conspicuous. The common conch of the coast, Busycon pyrum had been found spawning under the sand, the egg-cases always being attached to a shell at least eight inches below the surface. He had been interested in the numerous saw-fishes which swim about in shallow water. When approached, they settle quietly in the sand until partially covered, when, feeling secure, they will allow themselves to be almost touched before darting away. In this condition, they are readily held down with a spear, when they elevate the head, turn up the saw, and pull it repeatedly, and with sufficient force to make a deep notch in the wooden handle. —— Referring to the collection of sponges, Mr. Edward Potts remarked that they were all siliceous, with the exception of one interesting calcareous species. He had received several fine fresh-water sponges from the St. John's River, in the neighborhood of Palatka, collected by Mr. Mills of Buffalo. He believed one of the forms to be an undescribed species of the genus Meyenia, for which he proposed the name subdivisa. He was informed by Mr. Willcox that the comparative scarcity of fresh-water sponges in that region was, doubtless, owing to the superabundance of confervoid growths, which not only covered submerged logs, etc., but also flourished on the backs of the alligators.

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## NOTES AND NEWS.

THE *American* of Philadelphia announces the *personnel* of the new biological department of the University of Pennsylvania as follows: "At the head, as director, and professor of anatomy and zoölogy, was placed, of course, Dr. Joseph Leidy, whose selection guarantees to the scientific world the value of the new department. With him are to be associated Dr. J. T. Rothrock, professor of botany; Dr. A. J. Parker, professor of comparative anatomy; Dr. Harrison Allen, professor of physiology; Dr. Horace Jayne, professor of vertebrate morphology; and Dr. Benjamin Sharpe, professor of invertebrate morphology. That there will be enthusiastic, earnest, and thorough work done, is insured by all of these names."

— *Nature* states that tickets have been applied for as follows for the Montreal meeting of the British association: members elected prior to October, 1882, 379; members elected since October, 1882, 181; associates (relations of members), 120: total, 680.

— Mr. W. T. Lynn, late of the Royal observatory, Greenwich, writing to the *Observatory*, on the eclipses

during the war of Xerxes with the Greeks, makes an attempt to decide upon the most probable nature and dates of these 'eclipses,' which have occasioned chronologists so much trouble, from the assumption that they were solar eclipses, and from the difficulty of finding any such eclipses that could be identified with them. In the history of Herodotus, two 'portents' are said to have happened in the sky (besides many terrestrial ones) during the memorable war between the Greeks and the Persians under Xerxes, and (after his flight from Salamis) under Mardonius. The first of the two is mentioned in the seventh book of Herodotus, where he says, that in the early spring, while Xerxes was at Sardis preparing to set out on the Grecian expedition, "the sun, leaving his seat in heaven, became invisible, and, instead of day, it became night." The date when this expedition, and the battles of Thermopylae and Salamis, took place, is considered to have been B.C. 480. No eclipse of the sun could, however, have been visible in western Asia during the spring of that year. Sir George Airy suggested, in 1853, that the total *lunar* eclipse of B.C. 479, March 14, was the probable cause of the alarm and inquiry of Xerxes. Mr. Lynn, reviewing briefly the evidence on this point, concludes that this 'portent at Sardis' (respecting which Herodotus could not have been in possession of full information) was really of the nature of some remarkable meteorological phenomenon. But of the other 'portent' referred to by Herodotus in his ninth book, Mr. Lynn regards his account as likely to be more accurate, as it was visible in Greece. The prodigy was this: "While he was offering sacrifice to know if he should march out against the Persians, the sun was suddenly darkened in mid-sky." Mr. Lynn finds that a large solar eclipse (but not nearly total) occurred on the 2d of October, B.C. 480; and he is inclined to the belief that this was the phenomenon which frightened Cleombrotus, the brother of Leonidas, who was in command of the Spartan troops.

— In a recent scientific *feuilleton* in the Paris *Débats*, Mr. Henri Parville quotes a reference to the singular action of oil on waves by Theophylactes, the Byzantine historian of the sixth century. The passage occurs in a dialogue on 'various natural questions.' The question propounded is, why does oil make the sea calm? and the answer given is to the effect, that as the wind is 'a subtle and delicate thing,' and oil is 'adhesive, unctuous, and smooth,' the wind glides over the surface of the water on which oil has been spread, and cannot raise waves, not being able to obtain any hold on the water.

— The Linnean society of New South Wales offers a prize of a hundred pounds for an essay on 'The life-history of the bacillus of typhoid-fever.' The essay should be received by the society not later than Dec. 31, 1884. The intention and wishes of the donor of the prize will be best given in his own words: — "The questions chiefly to be solved in the investigation of the life-history of the bacillus of typhoid-fever are: 1°. What are the specific characters of the organism, as distinguished from other bacteria? 2°. What are the changes, if any, which the organism undergoes in the human body? 3°. What are its modes of development and reproduction in the human body? 4°. What changes or metamorphoses, if any, does the organism undergo after ejection from the human body, or in any other condition of its existence? 5°. What fluids or other substances seem best adapted for the growth and multiplication of the organism? 6°. Can the organism live or be cultivated in pure or distilled water? 7°. What are its limits of endurance of heat, cold, dryness, or humidity? As far as these points are concerned, the author should confine himself entirely to facts which come under his own observation; and those should be given in detail, with a full explanation of the method of investigation. But in dealing with the results obtained by these investigations, and the consideration of the means whereby a knowledge of the life-history of this most dangerous organism may help towards its eradication, the theories and observations of others may appropriately be referred to; but in every such case the authority must be correctly cited. The chief points to be ascertained in this branch of the subject are: 1°. How, and under what conditions, does the organism get access to the human body? 2°. How can its growth be impeded, or its vitality destroyed, in the human body, without serious injury to the individual affected? 3°. How can it be eradicated or rendered innocuous in wells, water-holes, drains, etc.?"

The president of the society, in announcing the prize, remarked that the present seemed to be a very opportune time to bring this matter forward, as the subject was now engaging the serious attention of medical men, owing to the prevalence of typhoid-fever. He had been given to understand that Australia offered exceptional opportunities for the investigation of the bacteria, as the climate was favorable for their growth during the greater part of the year.

— Professor Tyndall has given during the past winter, at the Royal institution, a course of lectures on 'The older electricity, its phenomena and investigators,' showing what was known of electricity up to the time of Faraday; at first thought, not a promising subject, but apparently successfully worked out by the lecturer.

— Prof. C. A. Young's 'The sun' (one of the International science series) has been translated into Russian, as well as into French, German, and Italian. In England eight thousand copies have been sold, and it has been very favorably received in this country.

— A very ingenious arrangement has been made by the Great northern telegraph company of England for telegraphing to China. The peculiarity of the Chinese language is, that the single characters do not stand for letters, but words, of which there are six thousand. For use on the new Chinese lines, the company has had special wood blocks made, on one end of which the word and facsimile are cut, while on the other end a number specially standing for the word is cut. The telegrapher substitutes the numbers for the words in transmitting a telegram, while

messages arriving in the numbers are deciphered in the same manner by means of the blocks.

—An attempt will be made to place the collections of the late Dr. Engelmann, of which he made no disposal, in the Shaw botanic gardens of St. Louis.

—In a recent article on the Edinburgh university festival, *Nature* says, "Silently and unconsciously, perhaps, the universities are passing from the exclusive domination of the older learning. At Edinburgh the emancipation is far advanced, but has yet to take shape in a definite re-arrangement of the curriculum of study. No thoughtful scientific man would advocate a merely scientific education. The foundations of every man's culture should be laid broad and deep in those humanizing departments of thought which the experience of centuries has proved to be admirably fitted for the mental and moral discipline of youth. But the day is not far distant when it will be acknowledged that modern science must be admitted to a place with ancient philosophy and literature in the scheme of a liberal education, when in all our universities provision will be made for practical instruction in scientific methods, and when at least as much encouragement will be given by fellowships and scholarships to the prosecution of original scientific research as has hitherto been awarded to classical study or learned indolence."

—Dr. V. B. Wittrock, curator of the herbarium of the Royal academy of sciences, Stockholm, Sweden, has issued, in a handsome folio volume, the first fasciculus of his Erythraea exsiccata, in which he proposes to represent and illustrate all the known species and forms of this critical genus. He wishes to include the American forms, and, likewise, the few European ones which are naturalized in North America. In this view, he invites the correspondence and co-operation of those American botanists to whom species of Erythraea are accessible. No truly indigenous species occurs on our Atlantic border: so this announcement is particularly addressed to botanists in Arkansas, Texas, and especially New Mexico and California.

—Antimony ores have been found in numerous parts of New South Wales. The ore consists of oxide and sulphide of antimony, and occurs in original bunches, occasionally of a considerable size, enclosed in a quartz matrix, which forms the chief constituent of the lodes.

—Whoever wishes to consult a concise compilation on primitive metallurgy will find Dr. Andree's *Die metalle bei den naturvölkern* (Leipzig, 1884, 166 p.) a most useful work. The subject is divided according to the geographical distribution of the peoples using the metals. The first two chapters, about one third of the book, are given to the discussion of iron and copper among the Africans; another third is taken up with the consideration of Asiatic metallurgy; and this is followed by five chapters on the iron, copper, bronze, and gold of America, with a final chapter on the use of iron in the South-Sea Islands. There are fifty-seven figures of various native blast-furnaces, bellows and tongs, of Africa, Asia, and Malaysia, and of the metal implements and ornaments of America. These all are referred to their original sources. A great number of authorities have been consulted, and all are noted conscientiously. The work deserves a place in the working-library of every student of the primitive arts; while its method and style are such as to interest the general reader.

—In a lecture on the dawn of mind, delivered at Owens college, Manchester, Eng., March 28, by Mr. G. J. Romanes, he claimed that the whole structure of mind took its rise from excitability, or the aptitude to respond to nervous stimulus, which was a characteristic of all matter that was alive. Next to excitability, in an ascending scale, they had the functions of discrimination and conductibility. Discrimination he believed to be a function of all nerve-cells: it was the power to discriminate one stimulus from another, irrespective of the degrees of their mechanical intensity. Conductibility was a function which admitted the possibility of reflex action, and of the co-ordination both of muscles and of ideas. In the faculty of discrimination they had the physical aspect of that which elsewhere was called choice; because choice, if it was analyzed, was merely the power of discriminating between one stimulus and another. With the aid of an elaborate diagram, Mr. Romanes traced what he held to be the various grades in the process of mental evolution from excitability as the root of the mind. The diagram had forty lines or levels. Any given level represented the earliest stage in the development of all the faculties named therein; the animals in which, and the age of the human being at which, they first appeared; also the grade of development at which human intelligence was arrested in idiocy and deaf-mutism. The diagram was not, he said, a mere production of his imagination, but was the result of his study of the subject. At the bottom, on a level with excitability, he placed protoplasm. Reason, he thought, arose out of the powers of perception; for the simplest possible perception involved some act of inference,—an act unconsciously performed, perhaps, but performed all the same. Regarding reason in its lowest phase, it must be placed immediately above the association of ideas, because they might regard it as a process of unconscious or deliberate inference, and this occurred in monkeys, dogs, and elephants. Next above reason he placed indefinite morality, or the germ of conscience. Indefinite morality was the feeling of dislike at offending those for whom the child or animal having it felt an affection. Definite morality was much higher in the scale: it was, in fact, at the top, on a level with man. A child at birth he placed, in this process of mental evolution, on a level with jelly-fish; at five months old, he put the child on a level with pigs, horses, and cats; and at nine months, on a level with the anthropoid apes. He could not help feeling that the doctrine of evolution, as a whole, was a somewhat hard doctrine,—hard as an answer to the question which must at some time, or in some shape, have occurred to most: 'Shall not the Judge of the whole earth do right?' The answer that evolutionists made to that seemed to him to be a hard one; for it said, that in the order of nature the

race was always to the swift, and the battle, without fail, to the strong. Thus the voice of science proclaimed a new beatitude: 'Blessed are the fit, for they shall inherit the earth.' This doctrine seemed to constitute might the only right. But if this world was a world of sorrow, struggle, pain, and death, at all events, the result, so far, had not been altogether profitless. Whatever the 'far off divine event' might be, to which 'the whole creation moves,' the whole creation, with all its pain, and in all its travail, was certainly moving, and moving in a direction which made, if not for righteousness, certainly for improvement.

— The Italian government has determined to offer, on the occasion of the opening of the Turin exhibition, a prize of four hundred pounds for the most practicable process for the transmission of electricity.

— At a recent meeting of the New-York academy of sciences, Mr. G. F. Kunz stated, that while unpacking some specimens of fluorite from Amelia county, Va., he had noticed the display of phosphorescence, a pale greenish light, by the mutual attrition of the specimens, the same being excited also by the warmth of the hands. By the heat of a candle, this phosphorescence was increased, and, on a red-hot stove, became a deep emerald-green. This led Mr. Kunz to examine fluorite from over a dozen localities, and he found that only chlorophane yielded phosphorescent light by attrition. In Phillips's Mineralogy, edition of 1823, a specimen of fluorite, described by Pallas, from Siberia, is mentioned, which yielded light by the warmth of the hand. The fact that attrition will cause phosphorescence, Mr. Kunz considered new; and as the same result was produced by chlorophane from Branchville, Conn., it was looked upon as a new distinguishing characteristic between chlorophane and common fluorite, as pectolite from Bergen Hill is distinguished from the fibrous zeolites and other associated minerals.

— Dr. Otto Struve states, in a letter to Dr. David Gill, that, during the publication of vol. x. of the Pulkova observations, he has reduced a series of parallax measurements of $\alpha$ Tauri (Aldebaran) made thirty years ago. Twenty observations give for the parallax (from position-angles), $0''.500 \pm 0''.075$; while the distance-measures give $0''.538 \pm 0''.089$, the mean being $0''.516 \pm 0''.057$. The agreement of the values obtained by these totally different methods is to be regarded as evidence of a comparatively large parallax, and shows that there are still large parallaxes to be looked for among the stars.

— Mr. Khersevanoff, director of the Institut des ingénieurs des ponts et chaussées of St. Petersburg, has elaborated a project for a grand work on the physical geography of Russia. Woeikof, the well-known meteorologist, has just issued a volume on the climates of different parts of the earth. Barabosh has devoted some years to the study of Manchuria. The results of these studies, made on the spot, have at last been printed by the authorities, but the work is not on sale. The annexation of Merv has again called the attention of geographers to the great work of Grodekoff on the Turkoman country, of which the third volume has recently appeared, and the fourth is printing. A work by Alikhanoff, printed by the general staff, as well as the detailed report of Lessar, recently summarized in these columns, have been issued, but are also withheld from publication. Lessar has received the gold medal of the Imperial geographical society, and is again at work in the field, where he is charged with the reconstruction and improvement of the wells along the route from Askabad to Merv.

— The great chart of Russia in Asia, comprising not only the Russian possessions, but portions of China, India, Persia, the whole of Beluchistan and Afghanistan, and nearly the whole of Russia in Europe, has been appearing in sheets during the last six months, and is now completed. In spite of the faults inherent in such a vast undertaking, it will prove most useful; and the eight large sheets, on a scale of 1:4,200,000, are sold at the low price of ten francs.

— There has recently been formed at St. Louis the St. Louis society of microscopists. This organization is distinct from the St. Louis microscopical society. The officers are: president, Frank L. James, Ph.D., M.D.; vice-president, W. B. Hill, M.D.; secretary, H. Ohman-Dumesnil, M.D.; treasurer, Thomas F. Rumbold, M.D.

— A prison congress is to be held in Rome in October, 1884. The circular calling attention to the congress is issued by the U.S. bureau of education, with an apology for touching upon such matters as having to do with the discipline of this life.

— In the discussion at a meeting of the London Society of arts, on Dr. Percy Frankland's paper on Thames water-supply, Sir Robert Rawlinson gave some facts, from his long experience as a government sanitary engineer, that are of special interest with reference to the theories brought into prominence by the cholera commissions. He denied that the much-praised mountain streams were any purer in regard to organic matter than ordinary river-water, since "every particle of growing matter was imbued with ammonia, which would combine with the water, and there was also the chance of other forms of impurity from decaying organic matter," and they often had a bad effect on the health of strangers, who were well enough where the water was supposed to be much worse. "It seemed to be a question of acclimatization," and he believed that the changing from one class of water to another might be very injurious. "But, taking water as it is found on the surface of the earth, he would say, that, out of the whole population of the globe, ninety-five per cent must be drinking water, which, according to chemical tests, ought most seriously to injure the health; and more than fifty per cent of the water would horrify any person who had its chemical contents explained to him." In India and China, water was always polluted; and on the European continent wells were almost invariably sunk in farmyards. In 1833, 1849, and 1854, cholera prevailed in the district of Stafford-

shire, which drained into the river Thame, from which Birmingham draws its water-supply; yet Birmingham escaped. When there were two thousand cases of cholera in Newcastle-upon-Tyne, and the water at Tynemouth was so bad that it was sold in cans with flannel tied over the nozzles to keep the impurities back, not a single case of cholera occurred in Tynemouth. In the Crimea the Sardinian contingent of the army was stationed on a hill, and their water-supply was drawn from a large Prussian fountain in the oolitic rock; yet, of the sixteen thousand men, a thousand died from cholera in the first month. When he came back to England, he heard Dr. Snow explaining the theory that cholera-polluted water was necessary to the production of cholera; and he then said to him, that he must be mistaken, because he had seen, on the largest possible scale, that it was not a fact, and, whatever might produce cholera, he was satisfied that it could not be imputed in all cases solely to impure water.

— Appendix No. 7 of the coast-survey report for 1883 is a 'Table of depths for harbors on the coasts of the United States,' prepared in outline by Commander Lull, and expanded by Messrs. Bradford and Parsons. The harbors are arranged in order along the coast from Maine to Texas, and from California to Alaska; and for every one the depth of water is given for the various bars, channels, and anchorages at high and low water of mean and of spring tides. This occupies one hundred pages, and is followed by an index of twenty-four more, making a work of great thoroughness, that must prove of high value to all of our coasting-vessels. A brief introductory mention of the tides states, that along our eastern coast to St. Augustine, Fla., the tides show no diurnal inequality, the two tidal waves of a single day being practically equal in range. On the Pacific coast the tides are of the more normal type, showing a diurnal inequality in height of flood, that becomes most apparent when the moon is farthest north or south of the equator, and disappears when it is on the equator. This is also characteristic of the peninsula of Florida; but along the northern coast of the Gulf of Mexico, to the Rio Grande, there is but one tide in each lunar day, and that is of small range, and disappears when the moon is on the equator. 'Wind tides' are here very marked, especially with on or off shore winds that blow for several days. The range of tide can be closely determined from the harbor tables.

— The report of Admiral Mouchez, director of the Paris observatory, was presented to the council at a recent meeting. The number of meridian observations made in 1883 amounted to the number of 23,830, five times the largest number made at any other establishment. A new fifteen-inch telescope was completed during the year, and with it one of the satellites of Mars was observed during the opposition of January. After the reading of the report, there was a special discussion respecting the removal of the principal instruments of the observatory to a position outside the city of Paris. This project has met with much opposition in the academy and elsewhere; but the observatory feels obliged to urge it, from the impossibility of finding a good foundation for large instruments. A piece of ground was purchased from the city a few years ago, on which to mount the great telescope of twenty-nine inches aperture, which is now in course of construction. The whole region is, however, so mined by the catacombs, that no good foundation can be secured; and it is considered absolutely necessary to mount it outside the city. It is considered that the grounds now owned by the observatory could be sold for a sum sufficient to found a new establishment.

— Mr. Arthur F. Gray has earned the thanks of conchologists by preparing, in a neat octavo of twelve pages, a complete list of the scientific papers of Thomas Bland. The works of this veteran and philosophical student of the Mollusca extend over the period of thirty years subsequent to 1852, and are seventy-two in number. Several were published jointly with Mr. W. G. Binney, and the series is one of which any naturalist might well be proud. We trust Mr. Bland may be spared to enlarge it indefinitely.

— The immense work of Mr. Elisée Reclus, the *Nouvelle géographie universelle*, begun in 1874, has now reached its ninth volume. The subscribers have received their promised instalments regularly, and without fail. The last volume deals with southwestern Asia. The *Athenaeum* says, "That one man should have been able to do so large an amount of work, is matter for surprise; and that he should have done it so well, is almost phenomenal.

— Lieut. E. K. Moore, in a paper reprinted from No. 29 of the Proceedings of the U. S. naval institute, has given a detailed description of the method of testing chronometers at the Naval observatory. A small 'temperature-room' was built with double walls, the space between the walls being filled with sawdust. This room is heated by the circulation of hot water, and is cooled by ice in a refrigerator beneath the flooring, when a temperature below that of the outside atmosphere is required. The heating-apparatus, which is in a room adjoining the temperature-room, consists of a small copper boiler, under which are two Bunsen burners. The boiler is fed from a tank overhead. In the gas-pipe supplying the burners, there is a spring valve, operated by the armature of an electro-magnet. Two minute gas-jets serve to light the larger burners when this valve is opened. The electro-magnet is in circuit with a mercurial thermostat, which is so adjusted, that, when the mercury in the tube of the thermostat is at or above a height corresponding to the temperature at which it is desired to keep the room, the circuit is closed, and the gas is cut off from the burners; but, if the mercury falls below this point, electric contact is broken, the valve is opened, and the water heated and caused to circulate in the pipes which pass around the room and return to the boiler. This automatic arrangement has been found to keep the temperature within a range of two degrees.

Some time during the cooler months of their trial, the chronometers which are to be tested are placed

in the temperature-room for about fifty days, and during this time they are given two tests at three different temperatures (between 45° and 90°); one set going from a lower to a higher temperature, and one from a higher to a lower, always beginning with one extreme, and ending with the same. The chronometers are also tested for polarity by rating them with the XII of their faces north, south, east, and west successively. "Great care should be taken, when chronometers are suspended in their gimbals, that they swing perfectly free, but without play enough to give them a jar; and the gimbals should be so adjusted that the chronometers will always hang with their faces level." Two chronometers, both running very regularly, were canted 9°, first with the XII down, then with the VI, IX, and III down successively, leaving them two 'terms' of seven days in each position, and placing them level again for two terms between the successive changes. "They both *lost* on their level rates, varying from five-tenths to three seconds, and were more or less irregular; but, when placed level again, they each time came back to their regular rates, running a little irregularly at first." The paper is illustrated by a number of drawings of the apparatus, diagrams of temperature curves, etc.

— The following item comes from the Pilot-chart data, collected by the hydrographic office, under date of Philadelphia, May 15: "Schooner M. A. Nutter (British), at this port, from Bahia, reports on April 21, at 9 A.M., latitude 21° 6′ north, longitude 61° 44′ west, the vessel was shaken from stem to stern by the shock of an earthquake, apparently from the westward." The position assigned for the vessel places it in deep water (about three thousand fathoms), about two hundred miles north-east of Sombrero, Windward Islands; and the date of the shock is noteworthy as being a day before the recent disturbance in England.

— Herr Moritz Honigmann's fireless locomotive, worked by chemically induced heat, has been used regularly since March 31 for passenger-traffic between Stolberg, near Aix-la-Chapelle, and Würfelen. When charged, it is found, the locomotive will go for twelve hours.

— Capt. Sörensen has communicated some important observations, taken in the arctic seas, to the Société de géographie of Paris. They include numerous rectifications of the charts of Spitzbergen, especially of the shores of the canal between the West Island and Prince Charles Island, and of Wood Bay, the head of which is divided into two arms, like Wijde Bay. From Cape Platen, North-east Land, Capt. Sörensen saw on the 28th of August, to the north and east, a land composed of an elevated plateau, cut into two parts by a fiord. A shipmaster from Tromsö also saw this land in 1876, and it is indicated on a chart of these seas issued at Tromsö by the captains of that port. This is probably the Gillis Land of old charts, lying between Spitzbergen and Franz Joseph Land.

— One afternoon, during the recent cruise of the Albatross, in the Caribbean Sea, several boobies were flying around the ship; and finally one of them alighted on the forecastle, when he was caught by one of the men, who, after amusing himself and his ship mates a while, tossed it overboard, expecting it would take itself off as quickly as possible; but, to their surprise, it returned immediately, alighting on the rail, where nearly every man of the crew had congregated to watch its performance. It did not seem to be distressed in any way, and went deliberately to work re-arranging its plumage, which had been somewhat ruffled by handling, calmly surveying the noisy crowd of men gathered around it. They tried to feed it, offering every thing that could be found, but nothing seemed to suit its taste. It would not submit quietly to being handled, but made no attempt to fly away; and, although tossed overboard six times during the afternoon, it returned as often, invariably alighting in the same place among the men, where it finally took up its quarters for the night, remaining till six o'clock the next morning, when it left without ceremony, and was not seen afterward.

— The working in agate, jade, and chalcedony, done at Idar and Oberstein in Germany, was described by Mr. G. F. Kunz at a recent meeting of the New-York academy of sciences, and many of the articles manufactured there exhibited. Some perforated carnelian ornaments were shown, in which the perforations, round at one end and over an inch across, run to an acute point, and vary in length from two and a half to four inches. These ornaments are sent to the interior of Africa, and sold at from four to five cents each, and are there worn by the natives. A jade pendant was shown over an inch and a half long, being one of a lot of over two hundred pounds of jade made up and sent to New Zealand. Mention was made of a mass weighing nearly three hundred pounds, to be used for the same purpose. The cost of making these ornaments at Oberstein was about forty cents each, which was much less than they could have been made for by native or skilled New-Zealand labor. There was also exhibited an oval carnelian disk that had been shaped for cutting by chipping with a small hammer: this chipping is equal to any that can be seen on American stone antiquities, and the entire cost is perhaps one cent. Some onyx beads were also shown, that in London or Ceylon would bring from ten pounds to twenty pounds sterling per string, and were here made for as many dollars. Mention was made of an American who achieved a fortune by importing the elephantine dentalium from the Red Sea, and selling to our American Indians. These instances illustrated the far-reaching influences of modern commerce in the most remote regions of the earth, and also the increasing difficulty in determining the genuine character of supposed aboriginal work in jade, chalcedony, and other similar material.

— Charles Adolphe Wurtz, the distinguished French chemist, died May 12, in his sixty-seventh year.

— The Houghton farm has issued in pamphlet form (ser. iii., No. 3) an account of experiments on the diseases of plants as affected by different fertilizers and the condition of the soil.